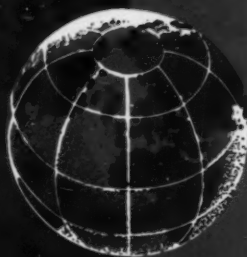


MINING WORLD

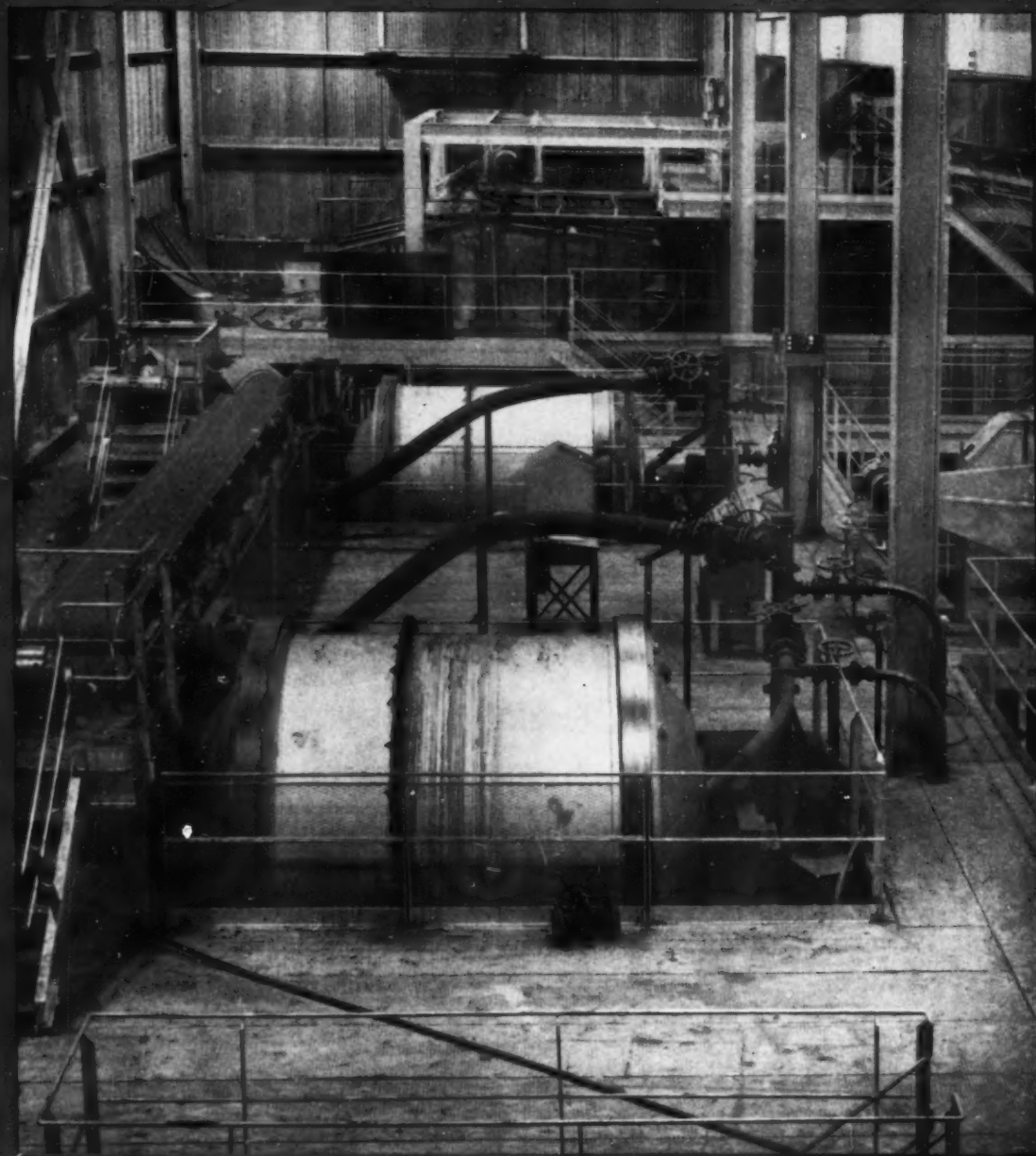


MARCH 1959

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Uranium Stopes Page 44

Can Sea Bottoms Be Mined
For Minerals? Page 39



Trout Lake HMS Plant
Page 34

PRODUCER

The Wemco-Remer Jig:

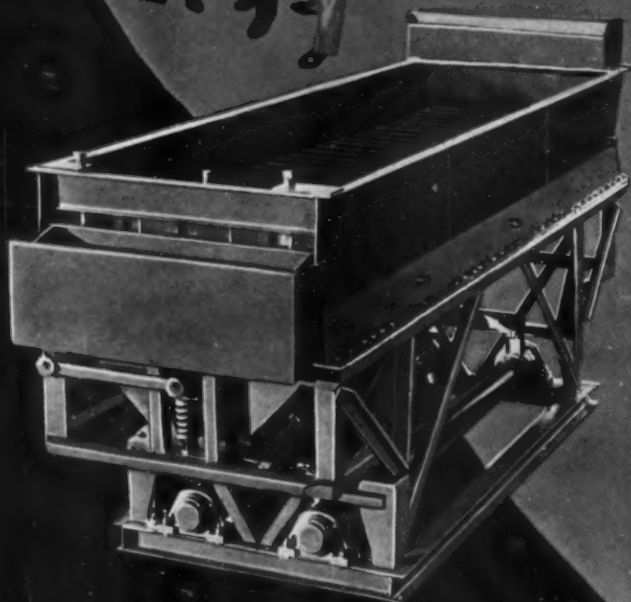
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The operating capacity — and results — of the Wemco-Remer Jig are more than ever a profit factor in the world's large operations.

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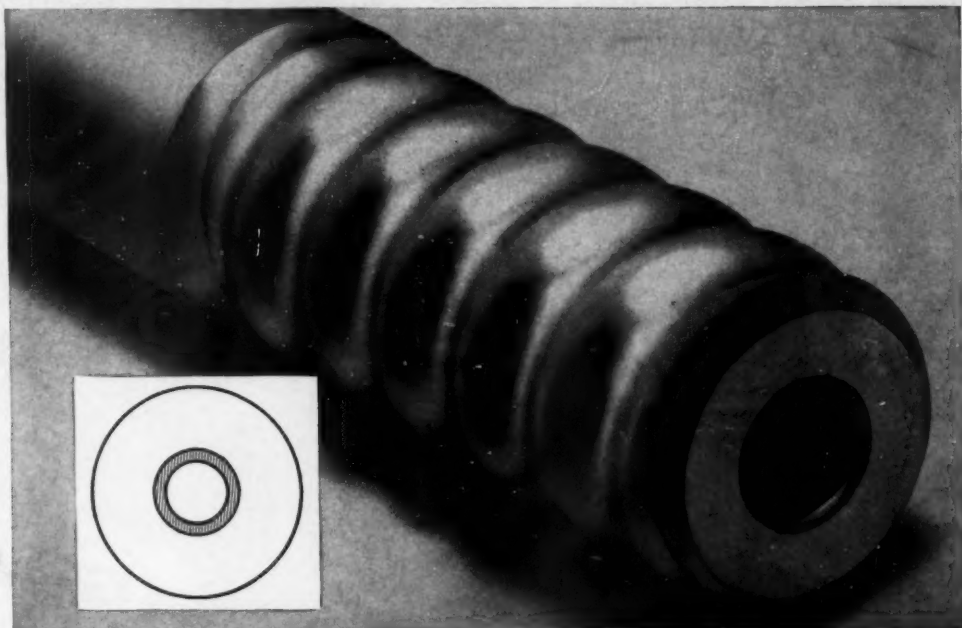
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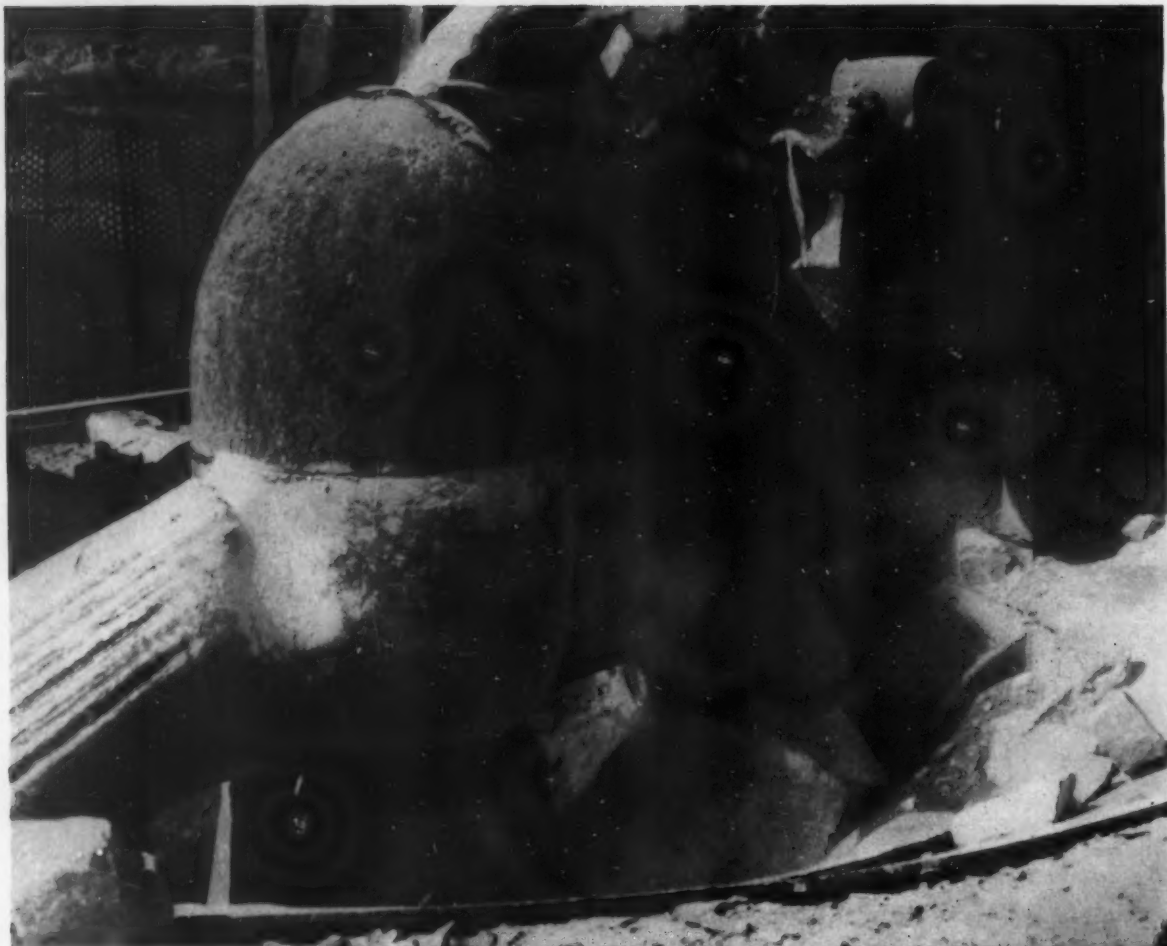
Connections used in extension drill-steel must be easy to assemble and uncouple, and connections must not become weak links during the actual drilling. Sandvik Coromant's new patented rope thread makes it easy to join and uncouple the equipment . . . yet gives a solid and positive connection. The gently rounded form of this thread means trouble-free performance—eliminates common thread and coupling failures found in "saw-tooth" threads. The complete equipment—bit, rod, coupling sleeve and shank adapter—are all dependable Sandvik Coromant parts made of world-renowned Sandvik alloy steel. A further advantage to the user is that the steel can be re-threaded. Atlas Copco has special literature on Sandvik Coromant extension steel and long-hole drilling, available to you with no obligation. We suggest you write today!



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67 Wall St.



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Mining World

Including the Export Edition WORLD MINING
Published monthly except in April when publication is semi-monthly

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ON THE COVER

The two 10-by 10-foot drum separators shown on the cover are part of Oliver Mining Company's new HMS addition to the Trout Lake Plant. They treat plus $\frac{3}{16}$ inch ore.

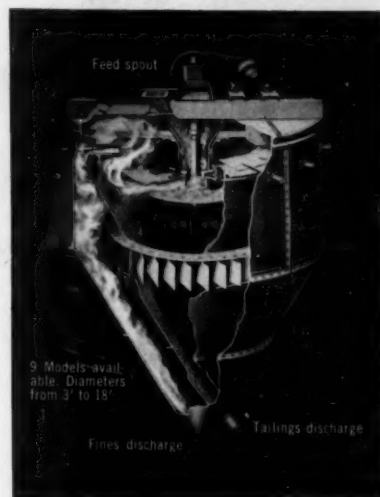


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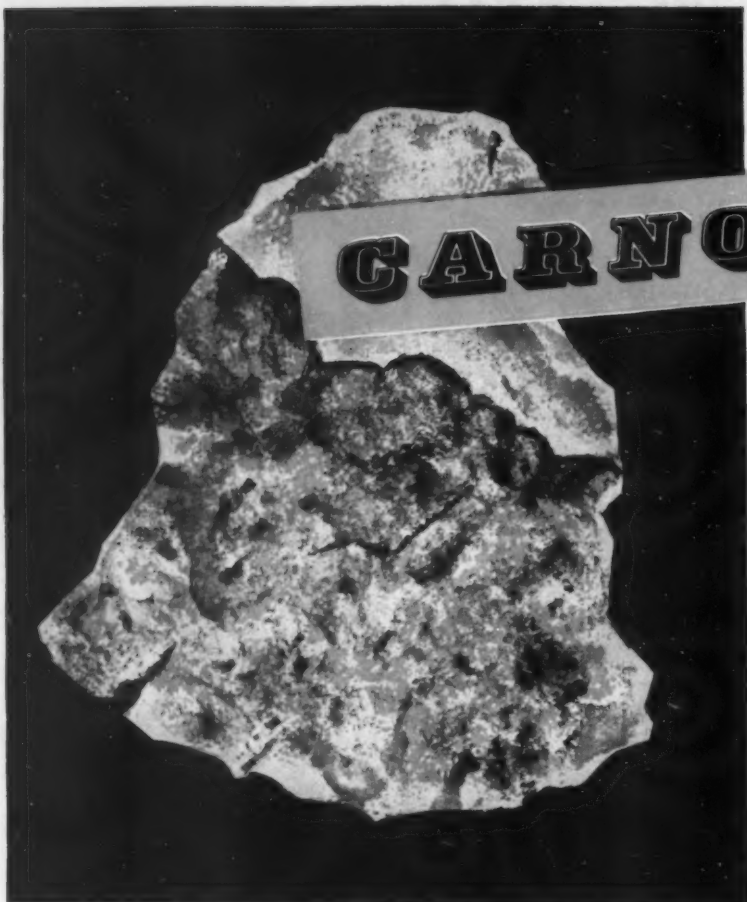
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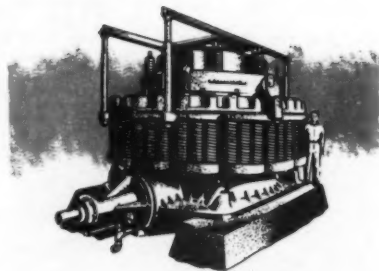


A complex mineral containing uranium, vanadium and radium, Carnotite is usually recognized by its yellow mineral color and nonmetallic luster. First discovered in Colorado, it was taken to France for analysis and there named for the French mining engineer and chemist, Marie-Adolphe Carnot.

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MARCH 1959

Drifts and Crosscuts

Why Mining Needs Public Relations

The mining industry got a black eye from strong-swinging bird watchers, nature boys, and so called conservationists in the Battle of the Porcupines.

On September 10, 1957, Kennecott's Bear Creek Mining Company submitted a copper lease application to the Michigan State Conservation Commission for an exploration permit in the Porcupine Mountain State Park. The lease was to cover 933 acres on the south shore of Lake Superior and 5,000 acres under the bottom of the lake.

Eastern newspapers, wildlife groups, and scores of organizations, with such names as Nature Association, Nature Conservancy, Wildlife Management Institute, and the Wilderness Society, raised the battle cry "To Save The Porkies."

Meanwhile, the Commission held a public hearing last year and had its engineering staff study the situation, with a final decision scheduled for January 9, 1959.

Popular slogans were coined to fight mining in the area, to prevent refuse heaps and poisonous fumes, and to Preserve the Porcupines as All America Must Fight. Thousands of pieces of mail were received daily by the Commission bearing only a special "Save The Porcupine" stamp and the name of the sender.

On January 5th Bear Creek withdrew its application by letter which said that restrictions as to the lease recommended by the Conservation Department would have created operating uncertainties.

When Bear Creek threw in the towel, there was widespread publicity of the "good news," that "Copper Company Drops Plans for Mine in Park, Row Fizzles Out, Bear Creek Withdraws Application, and Veto By State Was Expected."

Almost simultaneously in other parts of the nation support by many well meaning but uninformed people was being made for United States Senator Neuberger's so called "Wilderness Bill." During hearings in the west the Senator gave more time to college students than to engineers and business men representing employers of thousands of men.

The mining industry is wrongfully being abused. The industry has done more than all the bird watchers and natural science teachers combined to carefully and realistically develop the "Wilderness" for the benefit of all citizens as well as the nation. Miners have opened the wilderness, built roads, erected cities and produced minerals for our high state of civilization.

Miners and mine operators are keen sportsmen, too. They like to hunt and fish as well as the naturalists. The big difference—They are real sportsmen—They are real conservationists by proper use of natural resources. For without proper use, this would have remained a bow and arrow, birdly wilderness.

Public relations will go a long way to prevent frenzied cries of "Mining Destroys Our Wilderness Heritage."



"JOB-TAILORED ESCO DRAGLINE BUCKETS SOLVED OUR DOWNTIME, MAINTENANCE PROBLEMS"

...reports Howard Harrison, mechanical supt., C. A. Pitts General Contractor Ltd., Toronto.

"The material in which we are working," explains Howard Harrison, mechanical superintendent on a St. Lawrence Seaway job involving the removal of 16-million yards of glacial till, "is an extremely hard mixture of clay, gravel and boulders." "Our original buckets broke down frequently in this unexpectedly tough going. Maintenance was costing us more than \$100 per week per bucket. Then we checked with our *ESCO* representative, who sent *ESCO* bucket specialists to look into our problem. They recommended the use of two 6-yard *ESCO* HDH Triple Tapered buckets, custom-engineered to our requirements. The *ESCO* buckets immediately reduced our maintenance costs, and we were able to work the two draglines with only one spare bucket for each instead of two previously required."

ESCO bucket specialists can furnish dragline buckets tailored to your specific requirements. See your *ESCO* dealer for details, or write direct.



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MINING WORLD NEWSLETTER

Tsumeb . . . Columbus . . . Esterhazy
March 1959

Electronic-age metals are coming to the fore!

Commercial production of wrought rhenium rod, wire, and strip has been announced by Chase Brass & Copper Company, a Kennecott subsidiary. With a melting point of 5,756° F., surpassed only by tungsten and carbon, it should have many high temperature applications. One promising use is as an electrical contact where it offers great stability under high temperature arcing.

Germanium production is growing as its uses increase. Electronic devices are consuming more and more. Tsumeb Corporation of South West Africa is now building a plant to process its germanium-bearing concentrates into technical grade germanium oxide. Production is expected early in 1960.

Copper, lead, and zinc are always in the metal picture. In this case, they contribute rhenium and germanium as by-products.

The superior properties of both of these metals will overcome the high prices needed in order to produce them.

New uses for the well-known metals continue to develop.

Vanadium alloys have been produced successfully for the first time.

Vanadium sheet will now be available, not just bars and forgings.

First castings of molybdenum, another high temperature metal, was achieved recently by the U.S. Bureau of Mines.

Preparation of new compounds and investigations of their resistivity, thermal conductivity, and thermoelectric cooling is under study at Battelle. Materials to be studied will be compounds chosen from these systems: Cu, Ag, Au-S, Se, Te; Zn, Cd, Hg-As, Sb, Bi; alkaline-earth metals—Ge, Sn, Pb, As, Bi; and alkali metals—Ge, Sn, Pb, As, Bi. Alloys of these compounds will also be studied.

Ceramic coatings on metal gain in popularity for jet and missile applications, and as coatings for new lightweight alloys.

Carlsbad, New Mexico potash producers are stepping up their activities in Canada's Saskatchewan Province now that Potash Company of America is actually producing. A high-grade deposit, closer to agricultural markets, gives PCA a competitive advantage the other firms wish to offset.

International Minerals & Chemical's new Esterhazy mill is about finished.

U.S. Borax & Chemical is underway. Contracts reportedly have been awarded to Winston Bros. for shaft sinking and Stearns-Roger for construction of a mill.

American Metal-Climax, parent of Southwest Potash Corp., is drilling.

Durval Sulphur & Potash holds many leases in the area.

Behind-the-scenes reports at Denver (CMA and San Francisco (AIME)):

A possible copper discovery in Missouri.

A commercial "Comtac" plant designed for the Iron Ranges.

Uranium mining goes underground in Wyoming this year.

Butte pit will grow and grow. Radical new equipment will speed stripping of millions of tons.

FOR MAINTAINING HAUL AND ACCESS ROADS,
the No. 14 pays off with high capacity and high
availability. Its Turbocharged Cat Engine packs
the power to utilize a 12-ft. or 14-ft. blade at
highest practical working speeds!



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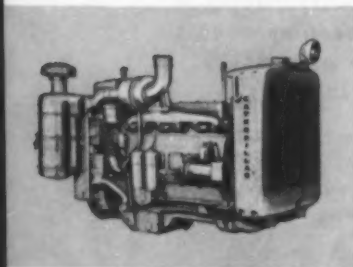
MOST VERSATILE BIG GRADER EVER DEVELOPED

In the new No. 14 Series B, Caterpillar brings you the most versatile grader ever developed in the "big machine" field. Another major achievement in Caterpillar's "Project Paydirt," it answers your need for a unit that comes through dependably with higher, faster, lower-cost production on your tough road maintenance and construction jobs.

The first and only Turbocharged motor grader, the 150 HP No. 14 operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. It

is built with extra strength to match its power and weight. It incorporates the latest engineering advances developed by Caterpillar research.

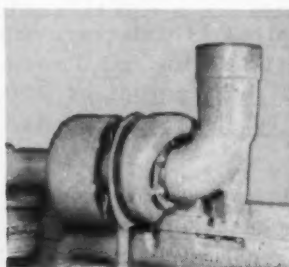
Example: New design permits increased clearance between moldboard and circle for greater loads. You'll also find exclusive time-tested Caterpillar developments. Example: The oil clutch. Some of these features are listed here, but there are many more. They all pay off in this one fact: You can use the No. 14 profitably anywhere.



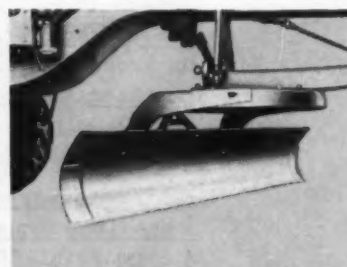
TURBOCHARGED CAT ENGINE: First and only Turbocharged engine in a grader. Its high torque rise of 18% pays off on your job.



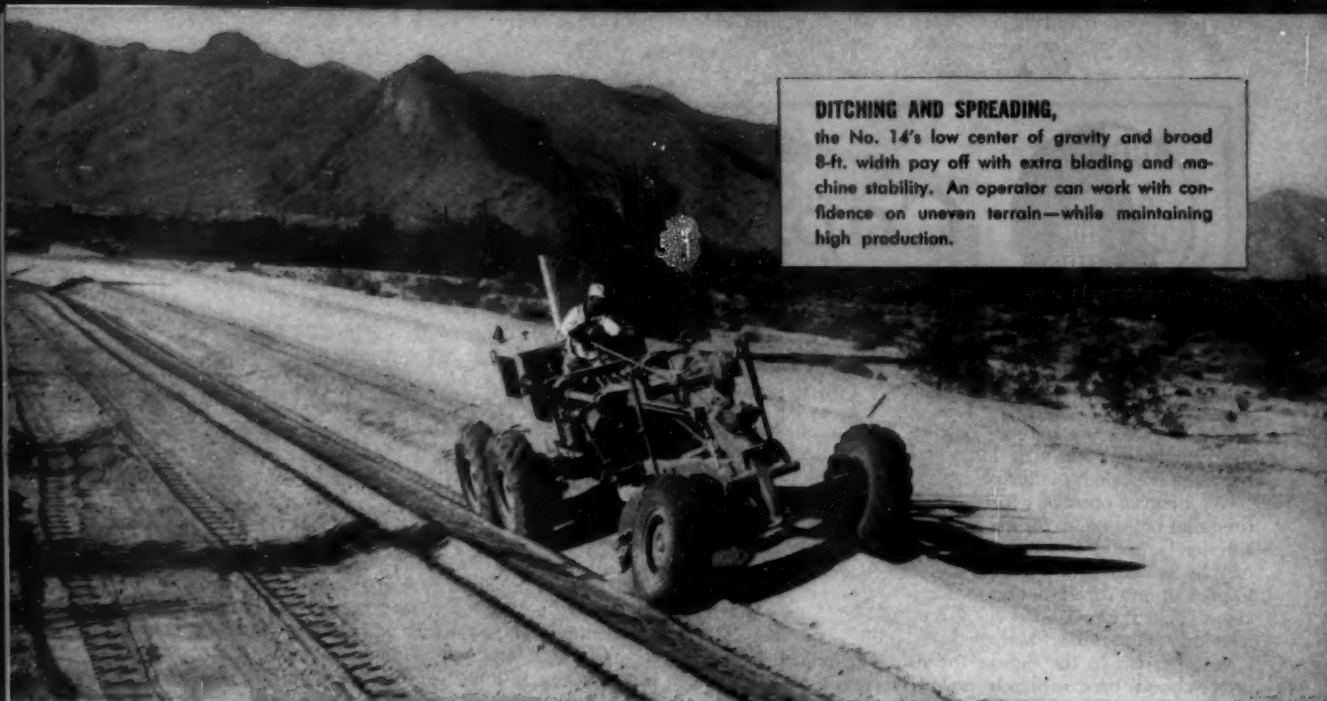
NEW DRY-TYPE AIR CLEANER: Removes 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes.



NEW TURBOCHARGER: Close-up of Cat Turbocharger which greatly increases over-all engine performance. First such unit in any motor grader.



HIGH THROAT CLEARANCE: New design permits increased clearance between moldboard and circle for unexcelled rolling action.



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Turbocharged Motor Grader

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As a result, you don't have to pick "spots" to make the No. 14 a sound investment. This modern, all-purpose big grader will earn its keep on every application with high capacity and low operating cost. But see for yourself. Get the complete facts from your Caterpillar Dealer. Just say when and where—he'll demonstrate.

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NEW TURBOCHARGED NO. 14

Engine HP (rated at sea level)	150
Weight	29,280 lb.
Blade—standard	12 ft.
Optional	14 ft.
Tires—all around	14.00-24
Travel speeds—6 forward, 2 reverse	2.6 to 21.6 MPH
Turning radius	36 ft.

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Capitol Concentrates

Administration Has No Plans To Send Long Range Mineral Program To New Congress

The remarks of Secretary of the Interior Seaton at a press conference early in January gave small comfort to the domestic mining industry.

Washington observers had been of the opinion for some time that no program for mining would be generated in the Interior Department, but Seaton buttoned this down pretty well by indicating that he had no plans, at present at least, to present mining legislation to the Congress. He was quite smug about the presumed effect the President's 80 percent lead-zinc quotas have had on prices which, by the way, have not risen to the figures the lead-zinc industry feels prices should be in order to create prosperity among the producers.

The Seaton remarks drew immediate fire from Senator James E. Murray, chairman of the Senate Interior and Insular Affairs Committee. Senator Murray pointed out that the long-awaited long-range minerals program promised by the administration has never actually come to pass, and that some attempts certainly would be made in the Congress to enact suitable legislation to aid closed-down mines.

It will be remembered that the Murray incentive payments bill, S. 4146 of the last Congress, which was reported favorably to the Senate, was the subject of critical remarks by the Interior Department. This bill was designed to aid the producers of beryl, metallurgical chromite, metallurgical manganese, mercury, antimony, cobalt and metallurgical-cal-grade fluor spar. A bill which would have saved the domestic asbestos industry was vetoed by the President and the House Appropriations Committee refused to do anything for tungsten. Not a very encouraging outlook!

• Budget Cuts OME Funds

An indication of how important mining is in the eyes of the Administration may be seen in the extraordinary reduction in funds in the President's budget for the Office of Minerals Exploration.

The 1958 budget, for the fiscal year 1959, called for \$3,963,000; the 1959 budget to cover the fiscal year 1960 calls for only \$1,500,000, a cut of \$2,463,000.

A balanced budget may be a fine thing, but economy waves always seem to hit hardest the services which may be minor in size but important to the national interest. When one considers the fact that hundreds of millions of dollars worth of ore have been found through the operations of OME, the term "penny-wise pound-foolish" may well be applied to this cut. Congressmen from mining states should vigorously oppose diminishing so drastically the effectiveness of this important agency. When Congress established OME by law it certainly could not have envisioned that the Administration would shrink it practically out of business.

• Chenoweth Bill Would Restrict Authority

The Treasury Department feels that it can control the price of gold by buying and selling the precious metal, even if free trading in gold should be resumed. Representative Chenoweth of Colorado proposes in H. R. 1242 to

plug at least part of this authority by prohibiting the Treasury from selling gold, for commercial use or in the arts or "for the purpose of depressing" the free-gold market which would be created by the bill.

• Opposition To Mineral Department Expected

The bill to create a United States Department of Mineral Resources has been reintroduced by Montana Senators Murray and Mansfield as S. 573.

Although the Interior Department has too many functions now to permit it to give proper attention to the needs of domestic mining (and apparently does not expect to come up with any helpful plan this year), it is expected to resist losing this part of its functions to another agency. That is the way bureaucracy operates!

• Lead-Zinc Industry Needs Permanent Legislation

Statements by government officials regarding the length of time that lead-zinc quotas may be kept in force indicate how risky such a device is for industry when authorized by executive order rather than by a specific statute. Recent comments hold out to producers that the present quotas may remain in force for at least a year. The President, it is understood, may modify or abolish the quota system at any time.

The present quotas were set at only a fraction of the quota restrictions recommended by the United States Tariff Commission, and in spite of them lead recently dropped 1 cent in price, putting lead and zinc both on a 12-cent per pound New York basis.

As has been pointed out a good many times, producers should decide upon some form of permanent legislation which will cost the government nothing when prices are good but which will save them from disaster on a sharply falling market.

• Tungsten Concentrates May Be Up-Graded

A request by General Services Administration for bids for up-grading tungsten concentrates indicates an interest within the Office of Civil and Defense Mobilization for up-grading materials held in inventory.

GSA has asked for bids to make 900,000 pounds of tungsten carbide from tungsten concentrates now in the hands of the government. These bids will be opened March 6, 1959, and two years will be allowed for the job.

• Bureau's Plans Should Be Questioned

In contrast to a tremendous budget cut in the appropriations requested for the Office of Minerals Exploration, the U. S. Bureau of Mines gets \$28,861,000 for 1960 or about the same as for the fiscal year 1959. Of this total \$11,119,000 is earmarked for a metals and minerals program to develop methods for commercializing large sub-marginal reserves, reducing production costs, and minimizing our dependence on foreign minerals and metals. This last phrase really is an eye catcher! When one reviews the mining picture and the past attitude of the Interior Department toward giving any substantial help to producers

of tungsten, mercury, chrome, manganese, strategic asbestos, and other domestic minerals, the production of which has been threatened or destroyed completely by foreign competition, one wonders just what the program will be to minimize dependence on foreign minerals. The subcommittees of the Appropriations Committees of both Houses of the Congress which deal with the Interior Department could well inquire about this of Secretary Seaton.

● Barter Deals Are Brewing

Although the domestic chrome and asbestos industries have suffered from the presumed fact that the national stockpiles are full to overflowing, a deal is on foot to barter some 60,000 tons of wheat for chrome and asbestos. It would be nice if the Administration paid a little more attention to the home mining front.

● Mills Offers Manganese Bill

A bill to enlarge and extend the carlot manganese program has been introduced by Representative Mills of Arkansas. It is H. R. 1930, which extends the time for completion of the program to June 30, 1964, and increases the amount from the current 28,000,000 to 90,000,000 long dry ton units. The limitation of 10,000 tons per producer per year would be lifted and no delivery limitation is specified. Judging from agency testimony given at various hearings held by the 85th Congress, it would be a sure bet that both the Interior Department and the Office of Civil and Defense Mobilization will report against the program, not to mention the Bureau of the Budget.

● Geophysical Bill Is Reintroduced

The geophysical, geochemical and geological mining claims bill has been reintroduced in the present session of the Congress after being dormant for several years.

This bill, drafted originally in 1947, attracted a great deal of attention at that time. Although introduced several times in both Houses of the Congress the bill never came to hearings. Now, with the great increase in geophysical prospecting and refinement of techniques, there seems to be a greater demand for a device which would permit holding large areas of the public domain for a long enough period to determine its worth for mining.

The present bill has been rewritten in a number of respects. However, the main changes involve increasing the time for geophysical, geochemical, and geological surveys from one to two years, increasing the time for physical exploration from one to two years, and increasing the area of the temporary claim from 640 to 5,120 acres. There is a good chance that the Interior and Insular Affairs Committee of the Senate will hold hearings on the bill this year to receive comments from industry.

COMING CONVENTIONS

March 23 through 25. Sixth Annual WESTERN SAFETY CONGRESS and Exhibits, Ambassador Hotel, Los Angeles, California.

April 2 through 6. The 55th annual meeting of the CORDIL- LERAN SECTION of the Geological Society of America. Hosts for the meeting on the University of Arizona campus at Tucson are the University, the Arizona Geological Society, and the Arizona Academy of Science.

April 20, 21, and 22. The Third SYMPOSIUM ON ROCK MECHANICS sponsored by the Colorado School of Mines, the University of Minnesota, and the Pennsylvania State University, Golden, Colorado.

April 22, 23, and 24. Annual meetings of the LEAD INDUS- TRIES ASSOCIATION and the AMERICAN ZINC INSTI- TUTE, Drake Hotel, Chicago, Illinois.

May 8, 9, and 10. Fourth Annual URANIUM SYMPOSIUM, sponsored by the Uranium Section of the AIME, Moab, Utah.

July 15 to 17. INTERNATIONAL SYMPOSIUM ON SHAFT SINKING AND TUNNELLING sponsored by the Institution of Mining Engineers, Olympia London, England.

August 17 through 28. Fourth annual course in MODERN IN- DUSTRIAL SPECTROSCOPY, Arizona State University, Tempe, Arizona.

FLYGT



"ON OUR GRANTS, NEW MEXICO, WORK FLYGT PUMPS ARE THE ONLY PUMPS WHICH CAN DO THE JOB"
reports
Boyles Bros. Drilling Co.

Well-known as mining contractors, engineers and geologists, Boyles Bros. Drilling Co. are sinking a variety of shafts in the famous Ambrosia Lake uranium district near Grants, New Mexico. The roster of Boyles Bros.' customers includes leading names in the mining and petroleum industry—firms which demand efficient equipment to obtain top performance. When it comes to de-watering, Boyles Bros. depend on Flygt Submersible Electric Pumps.

Boyles Bros.' Mr. Victor L. Stevens, in his own words, puts it this way: "We have on our shaft jobs in Grants, New Mexico, 3 Flygt B-150s and 9 Flygt B-80Ls, and these pumps are solving the big problem in the Grant's area, which is abrasive sand particles where- ever water is encountered.

"We are using the Flygt B-150s and B-80Ls to handle a good part of our water, and they are very successful pumps. We feel that Flygt pumps are the only pumps that we know can do our job.

"We are concreting as we sink some of the shafts. When we hit water a lot of the cement washes out of the concrete lining and it is handled by the Flygt pumps. Where we were cement grouting off the water, a large amount of the cement went into the shaft and was pumped out by the Flygt Pumps," Mr. Stevens concludes.

FLYGT SUBMERSIBLE ELECTRIC PUMPS range in size from 1½"- 85 GPM capacity to 8"-3000 GPM capacity. Head capacities range up to 210 feet. Higher heads obtainable with FLYGT PUMPS in tan- dem. Weights range from 70 to 1200 pounds. Write for complete specifications.

CHECK THESE FLYGT FEATURES

- ✓ Electric, fully submersible, fully portable.
- ✓ Instant pumping—no priming, no installation.
- ✓ Runs dry without damage, resistant to salt water.
- ✓ Takes a high proportion of solids, frost and fire-proof.
- ✓ Practically no maintenance or supervision.
- ✓ Operates unattended, quick and easy to service.



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One P&H sells another because P&H "PROFIT·TONS" reduce quarrying costs all day...every day

More responsive dipper action, as much as 30% more bail pull, faster swing and *maximum* availability all add up to lower cost per ton—more net profit for users of P&H Electric Mining Excavators.

As much as 10% more production with P&H Electrics in leading mines and quarries throughout the world is the end product of patented *exclusive* P&H design principles.

MAGNETORQUE® . . . the most advanced hoist drive known for electric excavators. This hoist drive electro-magnetically transmits digging power from an A.C. hoist motor direct to the dipper. It provides higher bail pull and faster dipper fill with an *exclusive* degree of protection for the hoisting machinery from digging stresses.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators, it accomplishes the fastest work cycles known. This closed circuit, adjustable energy system has no moving parts, and offers reductions in control maintenance expense of as much as 80%.

Also, with P&H you get single source responsibility—an exclusive advantage experienced only by users of P&H Electrics. P&H manufactures their own electrical equipment—*designed specifically for electric shovel service*—as well as mechanical equipment.

P&H MINING EXCAVATORS

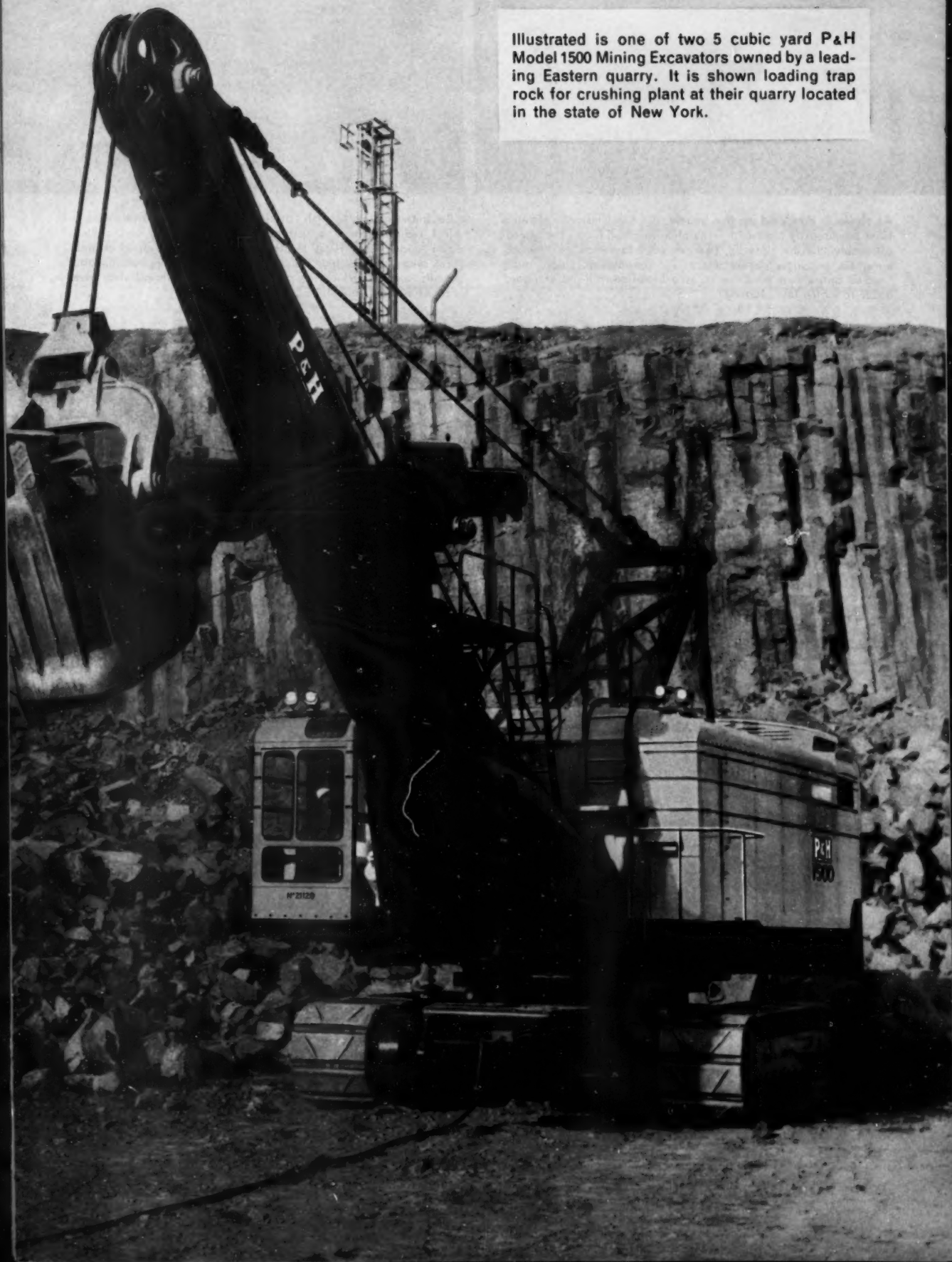


HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

P&H MINING EXCAVATOR LINE: 3½ through 10 cu. yd. capacities



Illustrated is one of two 5 cubic yard P&H Model 1500 Mining Excavators owned by a leading Eastern quarry. It is shown loading trap rock for crushing plant at their quarry located in the state of New York.





As shale is dumped on the grade, the 4-in-1 instantly changes from big-capacity loader to material-moving bulldozer. The operator simply lifts the clam lip, hydraulically, to switch machine actions. He regulates dozing depth with positive accuracy, using "radius control" of blade. It takes a bonafide, full-size standard dozer to match this capacity!



"Back-Dragging" with exclusive clamshell action, the 4-in-1 reduces time and cost of "dressing" a bank and pulling down "slide" rock. TD-20 shuttle-bar control speeds up back-and-forth cycles on jobs like this. Using clamshell in this position also permits speedy pick-up of stumps or loose materials that give straight buckets trouble.

"Our TD-20 Four-in-One does jobs impossible for regular dozer or loader"

—J. F. Coal Corporation, Summersville, W. Va.

"We have used the 4-in-1 for practically all phases of this work, often doing jobs impossible with regular dozer or loader," reports Russell Patrick, Manager, J. F. Coal Corporation, Summerville, W. Va. Prove to yourself what it means to get four-machine utility—bulldozer, excavator-loader, clamshell, "carry-type

scraper"—for one moderate investment. See how this "one-man equipment fleet" cuts operating cost and machinery investment—increases profit. Measure the performance-protection plus value of exclusive, shock-swallowing Hydro-Spring. See your International Drott Distributor for a 4-in-1 demonstration!

Applying its tremendous 43,150 lbs. of pry-over-shoe break-out force, this TD-20 4-in-1 shows how its power speeds heaping the 3 cu. yd. bucket full of shot-rock! The unit is helping build two miles of coal mine rail spur grade, from clearing to completion, in mountain terrain. Owner: J. F. Coal Corporation.

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin



INTERNATIONAL[®]
DROTT





What To Use for Jackleg Drilling...

I-R CARSET[®] SOCKET BITS

combine the advantages of **DETACHABILITY**
with one-piece **SIMPLICITY**

For small-hole drilling, in sizes from 1 1/4" to 1 3/4", Ingersoll-Rand now offers Carset bits with a tapered socket connection that combines the rugged simplicity of a one-piece carbide-insert steel with the convenience, flexibility and long-range economy of conventional threaded bits. A brass shim between bit and rod equalizes impact pressure in the connection. Bits are removed by a simple knock-off block.

With these I-R Socket Bits and tapered rods you get the unsurpassed *drilling speed* and service-proved dependability of a genuine Carset bit with four Carboloy inserts—plus all these other time-saving, cost-saving advantages:

- No need for forging or heat-treating equipment on the taper end.
- Rods reconditioned simply by taper grinding or lathe turning.
- Bit size can be changed without changing steels.
- A broken steel is not a total loss—you save the bit and can re-grind the end of the steel.
- Bit grinding is faster and easier—operator doesn't have to manipulate a long length of steel.

For maximum convenience and long-range economy on your next Jackleg drilling job, try I-R Carset Socket Bits. Bits and rods are available now in the following standard sizes:

I-R CARSET SOCKET BITS

Gauge	Symbol	Weight
1 1/4"	1 1/4 - XLS-5	10 oz.
1 3/8"	1 3/8 - XLS-5	12 1/2 oz.
1 1/2"	1 1/2 - XLS-5	13 oz.
1 3/4"	1 3/4 - XLS-5	15 oz.

I-R ALLOY STEEL RODS

Length	Symbol	Wt. per ft.
18", 24", 36" 48", 54", 60" 72", 84", 90" 96", 108" 120", 144"	JABXLA-(length)"	2.4



Ingersoll-Rand
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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

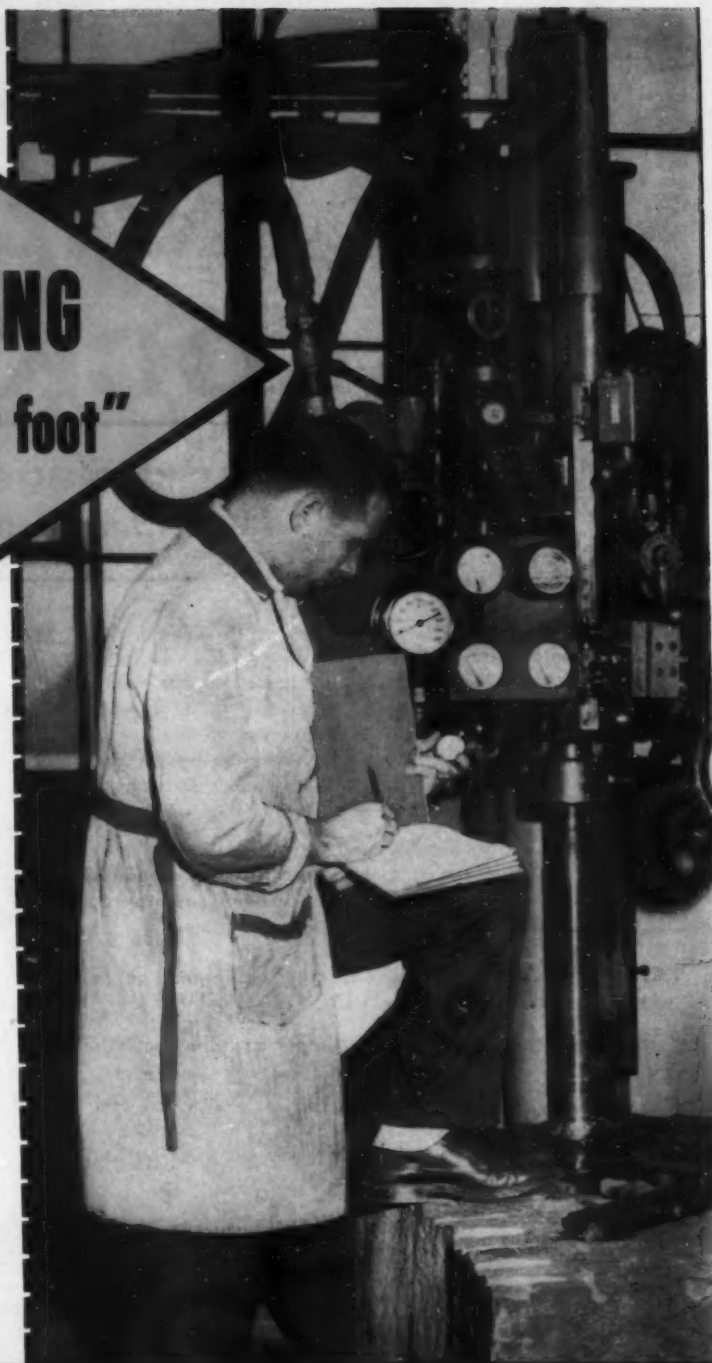
PRE-TESTING MEANS "less cost per foot"

The fundamental purpose of all Christensen Diamond bit research, whether in the field or in the laboratory, is to improve diamond bit performance.

This hydraulic diamond test drill, located in Christensen's main plant, provides a means of testing new bit designs, matrix composition and diamond sizes or patterns in a variety of rock types before field testing.

The rock used for these preliminary tests is gathered from many areas in the country and is selected from formations encountered in actual drilling operations.

These specialized tests enable Christensen engineers to increase penetration rates and improve bit life by determining the matrix materials and bit designs that assure the best results in each rock type.



For the right bit for your drilling requirements, call the nearest Christensen representative and learn how you can operate at "less cost per foot."

Diamonds Mean, "Less cost per foot."

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CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

New AEROMINE® Promoters for more efficient flotation of silica, silicates,-- improved slime filtration

Developed for use at Cyanamid's own phosphate rock operations, low-cost AEROMINE 3035 and AEROMINE 3037 cationic flotation collectors have proved effective in non-metallic mineral flotation and shown great promise as filtration aids for clay minerals.

From 0.1 to 0.5 lb. per ton of ore gives excellent recovery on silica and silicate mineral flotation. Combined use with kerosene or fuel oil affords still greater reagent economy. On Florida phosphate rock, AEROMINE promoters are usually diluted with two parts of kerosene to one part of AEROMINE promoter.

AEROMINE 3035 and 3037 Promoters contain the same active ingredient. AEROMINE 3037 is the water-soluble acetate form, while AEROMINE 3035 is the free-base form of the collector. AEROMINE 3035 can be fed as a solution in kerosene, fuel oil or a frother while AEROMINE 3037 can be dissolved in water for feeding, or fed like AEROMINE 3035.

As filtration aids, dosages of 0.2 to 0.5 lb. per ton of feed have materially improved filtration rates, particularly on clays and mineral slimes.

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Selenograph Explosives
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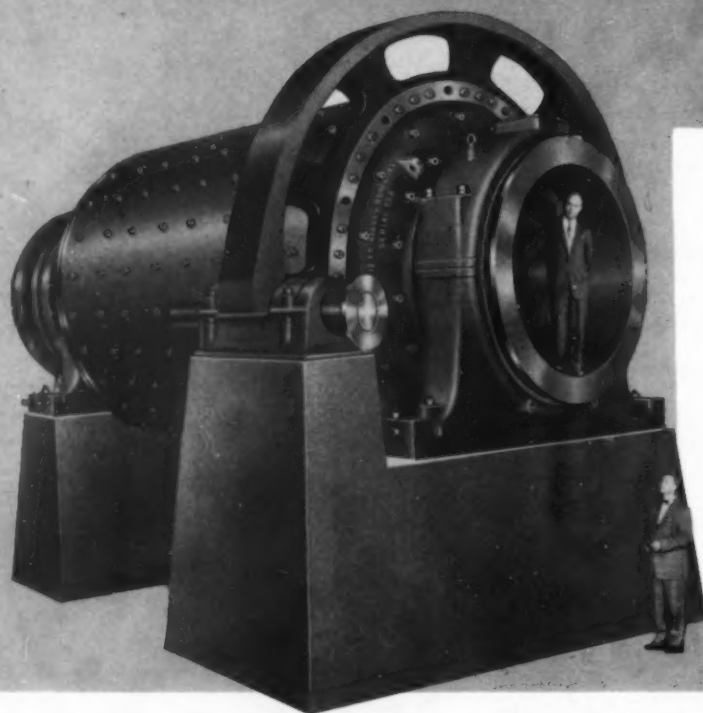
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Marcy Mills have a reputation for being
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One of two 12½' x 16' Marcy Open End Rod Mills, the largest rod mills ever built, designed by Mine and Smelter to meet a specific large tonnage milling problem. Compared with using 3 or 4 smaller mills they have the advantage of lower initial cost, less floor space, more efficient grinding, less power per ton, and lower labor costs...a typical example of how Marcy experience and engineering too, can save you money.

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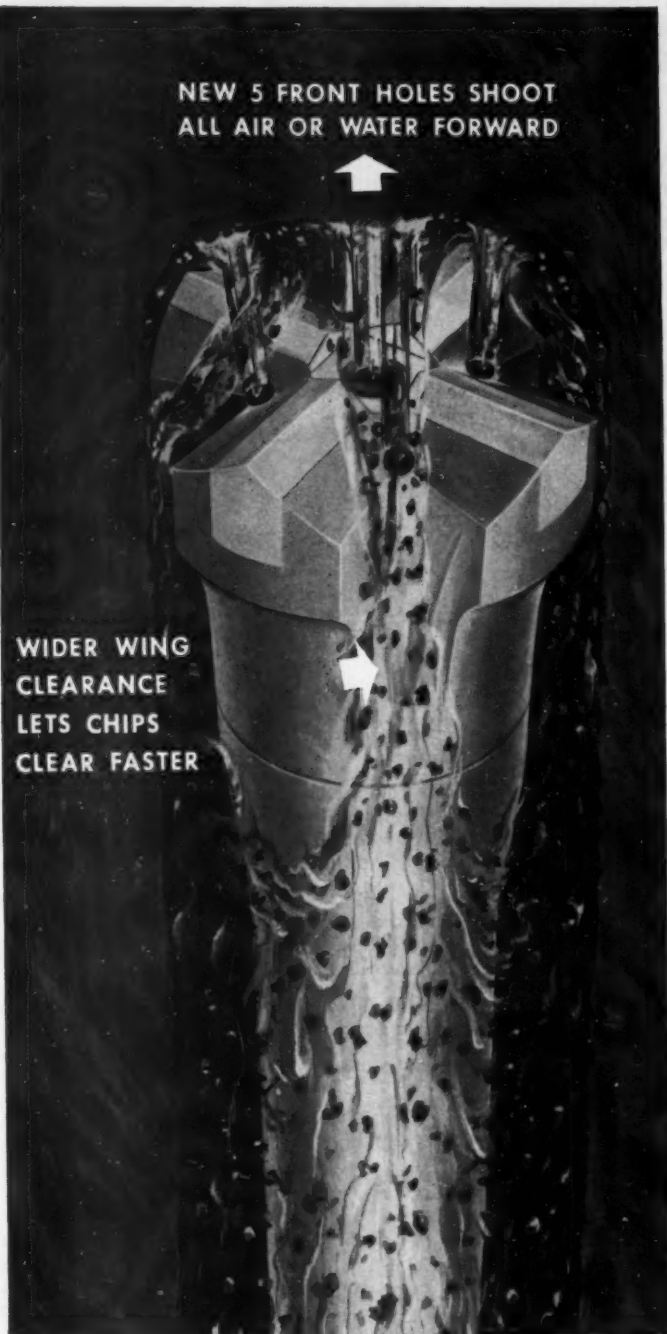
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For drifters, sinkers and stopers...

NEW 5 FRONT HOLES SHOOT
ALL AIR OR WATER FORWARD



WIDER WING
CLEARANCE
LETS CHIPS
CLEAR FASTER



NEW TIMKEN® THREADED BIT CLEARS CHIPS FASTER TO DRILL MORE HOLE- PER-BIT

When you use this new Timken® bit you drill rock—not chips—because chips clear faster. Its newly positioned 5 front holes jet-propel air or water against the rock face. And deeper, wider wing clearance and deeper relief under the heel help clear the chips extra fast. This quick wash-back ends the problem of clogged drill steels, protects your bit skirts against damage, lets you drill more feet-per-bit.

You get even more hole-per-bit because new special analysis carbides give this new Timken threaded bit greater resistance to shock and wear. And you can recondition it many times. Its redesigned heavier wing speeds drilling. Improved thread contact cuts breakage to a minimum.

For drifters, sinkers and stopers, this new Timken threaded carbide bit is the one to give you more hole-per-bit. For a free brochure that gives all the details write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

FOR OTHER TOUGH DRILLING JOBS



Improved Timken all steel multi-use bit gives you lowest cost per foot-of-hole—with correct, controlled reconditioning—when you can drill full increments of steel.



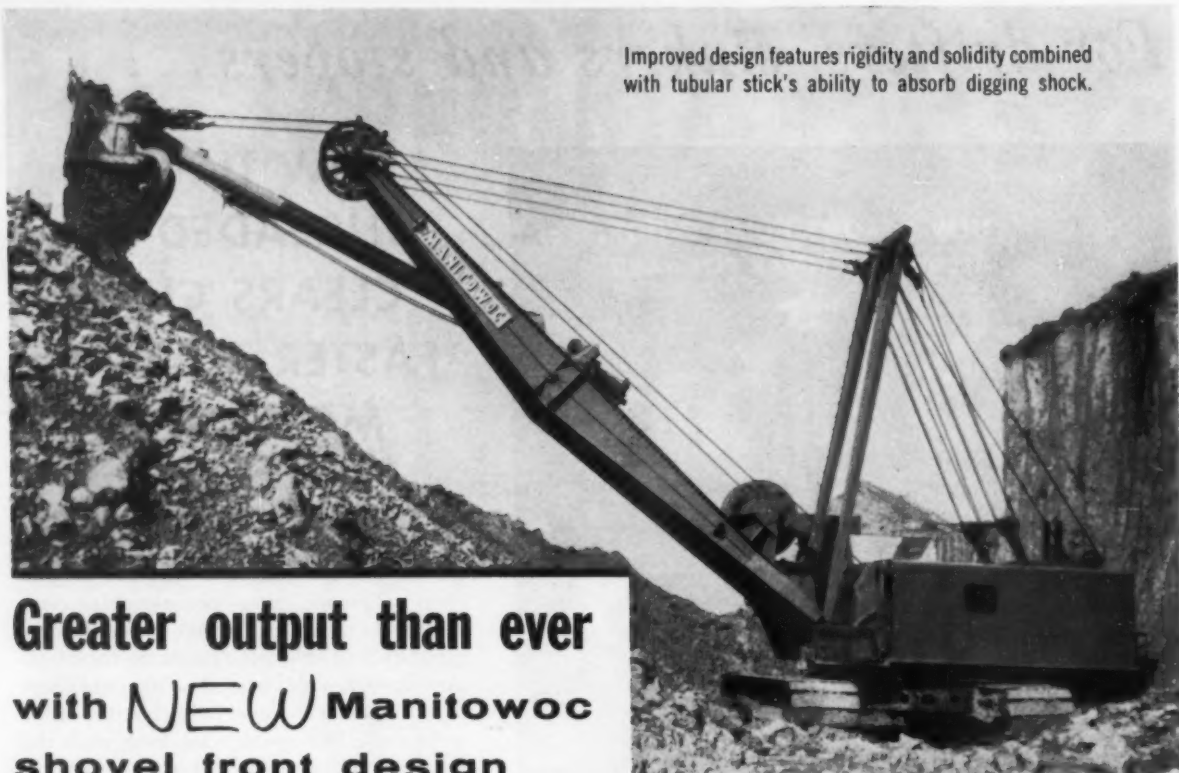
New Timken tapered socket bit is removable for full steel life, tapered for more secure union, and has same new frontal features as threaded bit. It's the air-leg bit of the future—here today!



TIMKEN

REMOVABLE
ROCK BITS

TRADE-MARK REG. U. S. PAT. OFF.



Improved design features rigidity and solidity combined with tubular stick's ability to absorb digging shock.

Greater output than ever with **NEW** Manitowoc shovel front design

- Better digging action
- Direct hoist power
- Absorbs impact shock
- 50% less cable wear

Now the powerful Manitowoc Model 4500 5½-yd. shovel combines an improved method of dipper suspension and direct application of hoist power to give you faster and better digging action . . . increased production . . . longer machine life.

DIRECT HOIST POWER. Two short cables, powered by a double-drum spool mounted on the boom base, are separately reeved through each boom point sheave and are attached directly to swivel sockets at the outside corners of the dipper bail. Power transmission is simple and direct, eliminating long cables and frequent sharp bends. Cuts your maintenance costs and down time.

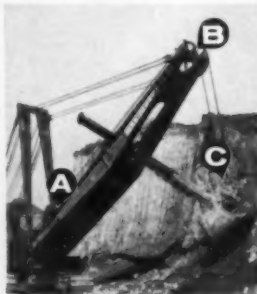
STABLE DIPPER SUSPENSION. With hoist cables attached to each side of the bail, and the bail block eliminated, you get widespread support of the dipper, added rigidity and stability in tough digging . . . yet you retain the shock absorbing features, resiliency and flexibility that tubular dipper stick design provides. You can still handle a rock too big to go through the dipper—simply lift it to the top of the spoil pile and as soon as you put slack in

the hoist cables, the dipper will turn sideways and "spill" the rock.

In addition, you get better bucket penetration and loading with less spillage because all linkages are in line, and the bucket is more stable in every phase of the crowd, hoist and swing cycles.

To get complete information on the all-new Manitowoc shovel front end design, ask your distributor for a copy of Form No. 23-58 or write to Manitowoc Engineering Corp. for full details.

Here's How It Works: Hoist power is transmitted by heavy cable from the shovel main front drum over the center of a large "Secondary" hoist drum (A) mounted at the base of the boom. Cables are rigged from each of the spools on the secondary hoist over the boom point sheaves (B) and tied directly to heavy duty swivel sockets on each side of the bail (C). The hoist power flow is direct and simple, without sharp cable bends.



Manitowoc

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(A subsidiary of The Manitowoc Company, Inc.)

MANITOWOC, WIS.

SHOVELS 1¼-yd. — 5½-yd. DRAGLINES 1¼-yd. — 6-yd. CRANES 25-ton — 100-ton

Right off the

Wire

1. A new teletypewriter can print 3,000 words a minute and has a theoretical top speed of 500,000.

⌘

2. Work has begun on a pilot model of a device for generating electricity from the controlled fusion of hydrogen at a temperature of about one hundred million degrees.

⌘

3. A new industrial pump has a piston that moves only a fraction of an inch, but at the rate of sixty cycles per second. It has no outside openings and cannot leak.

⌘

4. The "world's first" atomic house heating installation is being built underground in a suburb of Stockholm.

⌘

5. "Hydrogasification" is a one-step process that produces gas directly from oil shale with an efficiency of over ninety per cent.

⌘

6. A radar target made for small boats reduces the risk of their being run down by large vessels and also makes it easier for them to be found when in distress.

⌘

7. Heat radiation in amounts as small as one-twentieth of a billionth of a watt can be detected by a new instrument.

⌘

8. A traffic signal on wheels is battery operated and can be set up anywhere.

⌘

9. Tire treads made of a new synthetic rubber are said to be forty percent more durable than those made of natural rubber.

⌘

10. Power is transmitted to two of the world's largest coal-digging machines through 3 conductor, 7500-volt, Simplex TIREX shovel cables.

11. One hundred and twenty-five skilled workers will be replaced by a new automatic tester for transistors which will also make fewer errors.

⌘

12. A new metal-working plant will be air-tight and metals will be fabricated at high temperatures in an atmosphere of argon.

⌘

13. A three-dimensional mobile radar shows the direction, distance and height of aircraft.

⌘

14. A battery charger for outboard motors uses the generator of the towing car while the boat is on the trailer.

⌘

15. Earphones that cancel outside noises by creating neutralizing sound waves are being used experimentally by the Army.

⌘

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

⌘

16. Homes may be lighted, heated and cooled electrically by means of a type of panel now being developed.

⌘

17. A reading aid for the blind translates each printed letter into a different musical note.

⌘

18. An underground hospital is to be built which will have 650 beds. It is to be completed in 1960.

⌘

19. Molten sulphur will be pumped up from a depth of 2,000 feet under the floor of the Gulf of Mexico. The installation is being made seven miles off the Louisiana coast and the liquid will be pumped to shore for refining.

20. New gallery-type railroad passenger coaches and parlor cars are being used for medium-haul service. The bi-level streamliners, designed for high capacity and low weight per seat, use Simplex Car Wire throughout.

⌘

21. Growing under artificial sunlight, a new strain of algae multiplies a thousandfold in a day.

⌘

22. Fungi may have been the first living space travelers. It has been found that some spores can exist in a vacuum equal to that in interplanetary space.



Transatlantic Concert

One of the most notable musical events of all time took place recently at the United Nations building in New York. The concert, featuring the Boston Symphony Orchestra and distinguished musicians from Paris and Geneva, was highlighted by the performance of Pablo Casals, world-famed violin-cellist. This epochal musical treat was telephoned to seventy-five countries by the Bell System, over the transatlantic submarine cable, the American portion of which was made by Simplex.

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**Allis-Chalmers announces a new
motor grader in the 80-hp class**

the
ONE FORTY FIVE

- 80-hp Allis-Chalmers engine
- 21,540 lb

... Another outstanding motor grader joins the Allis-Chalmers line
the **ONE FORTY FIVE**



MODEL D

58-hp Allis-Chalmers engine
8,800 to 11,450 lb



ONE FORTY FIVE

80-hp Allis-Chalmers engine
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120-hp Allis-Chalmers engine
23,800 lb

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BEST BUY IN THE MEDIUM-POWER FIELD

- Heavy-duty throughout at a budget-saving price.
- Designed for construction as well as maintenance of haul roads. Compact enough for tight turns powerful enough for production grading, scarifying, cutting ditches for drainage.
- Retains the widely-accepted characteristics and performance features of the 120-hp Allis-Chalmers FORTY FIVE grader.
- Offers the best combination of operator features of any grader near its size.



Operator advantages no other medium-priced grader can give you... "wide-open" visibility... over-the-circle lift cases... suspended pedals and exclusive no-kick, toggle-type controls.

Power for high production. Husky, high-torque Allis-Chalmers diesel engine handles overloads without shifting down... geared for good range of travel and working speeds.

Load-handling ability second to none. The new ONE FORTY FIVE has a 26 $\frac{1}{4}$ -inch-high arched

front axle—and highest throat clearance in its class. You get more dirt to the ROLL-AWAY moldboard and move it with efficient rolling action that uses less power.

See the new ONE FORTY FIVE motor grader at your Allis-Chalmers dealer's. Check its dollar-stretching price. Then check its 80 hp and 21,540 lb on an actual demonstration. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

ROLL-AWAY is an Allis-Chalmers trademark.



....power for a growing world



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6583

THE IMAGE OF CF&I ...MAKER OF STEEL

He's a giant steelman. He makes good steel and steel products for the diversified needs of today's economy. He anticipates tomorrow's requirements. He is constantly improving products through research and new manufacturing techniques.

His steel mills extend across the country. In them, he guards every step of manufacturing by rigid quality controls. And in his national network of offices and warehouses, he not only *sells* steel products, but he *serves* their users in every possible way.

He is the dynamic image of CF&I . . . the symbol of dependable steel products. Look for him when you buy.

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JOY-HAZEMAG

IMPACT CRUSHERS

20 MODELS—5 TO 500 TPH CAPACITY

**SELECTIVE CRUSHING WITHOUT
EXCESSIVE FINES**

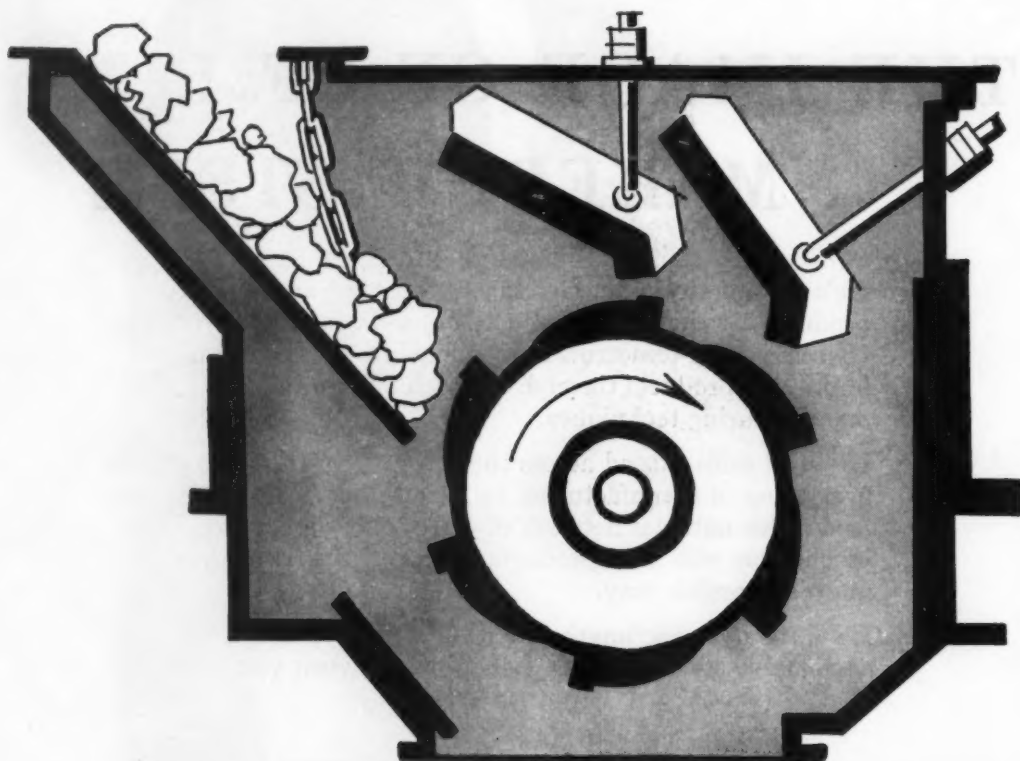
**Iron Ore • Asbestos Ore
Limestone • Coking Coal • Marble
Salt • Gypsum • Slag**

Joy-Hazemag Impact Crushers provide selective crushing of a wide range of materials with efficiency and economy. By adjusting the position of the impact plates and varying the rotor speed, material is crushed in a controlled spectrum of sizes.

Typical Examples: Coking coal can be crushed to greater than 90% through $\frac{1}{8}$ " while limiting fines (minus 100 mesh) to a minimum; Limestone for fluxing can be crushed to a maximum grade product in a one-pass reduction to minus $\frac{1}{4}$ " plus 100 mesh; Hard and soft parts of conglomerate can be crushed to different sizes in one pass, for recovery of mineral values in one fraction by a scalping screen.

Write for full information on how Joy-Hazemag Impact Crushers can give you better crushed material at lower cost.

WSW M-7414-279



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Strategically located for small lots or carload quantities...

See ASARCO first
buying, smelting, and
refining all types of ores:
GOLD, SILVER, LEAD,
COPPER AND ZINC ores
and concentrates, blister
copper, mattes and residues
22 Smelters and Refineries

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Corpus Christi, Texas
Rosita, Coah., Mexico

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ASARCO

"Our first 24's stripping record sold us on our

—Luttjohann Stone Co., Topeka, Kansas

"When our first Torque-Converter TD-24 went to work in November, 1957 it stripped 50% more overburden than its steering-clutch competitor," reports John Luttjohann, Luttjohann, Stone Co., Topeka, Kansas. "It cut our stripping costs per yard so much, we bought our second one in June, 1958.

"Now the two TD-24's are giving us lower stripping costs than we've had in recent years, in the face of generally higher costs. The Torque-Converter '24's' are superior machines, powerful enough to push big loads in all conditions, even when frequent heavy rain made a swamp of the quarry.

"'24's' are fast, so we can make the long pushes pay off. And '24's' are trouble free. We haven't lost any time with these two machines in almost 2,000 hours of the roughest work in the quarry."

Luttjohann Co. compared performance!

The Luttjohann's proved by direct comparison that their Planet Power-steered TD-24 could rip and strip 50% more overburden than a 20-ton steering-clutch competitive rig.

Planet Power steering eliminates load-limiting "dead-track drag," keeps full-time "live" power on both tracks. You don't "half-kill" your power and traction to control the TD-24—on turns as you must with any king-sized steering-clutch tractor. You get bonus-load follow through—and don't spill the extra-profit yardage with "jerky" steering.

You can "adjust" TD-24 track speed to assure full-bite performance, benching or highwalling—where steering-clutch rigs can only "nibble"!

Prove the big yardage increase you can get with a Planet Power-steered International TD-24. Measure the capacity increases you also get with this Hi-Lo, full-power planetary shifting. Check the fast production-boosting TD-24 reverse speeds. Ask your International Construction Equipment Distributor for a demonstration!



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A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.



economy second"



With the ripper-equipped Torque-Converter TD-24, the Luttjohann quarry rips tough rock layers into movable spoil. They push slabs of rock as heavy as 40 tons, with the blade. Daily crusher output average is about 1,000 cu. yd.

One TD-24 sells another by outproducing a king-sized competitive crawler by an amazing 50%—stripping overburden in side-by-side comparisons at Luttjohann Stone Co., Topeka, Kansas! Here are their Torque-Converter "24's!"

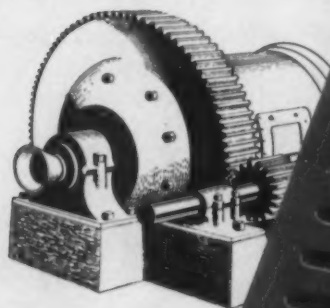


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NEW S-12

joins Euclid Rear-Dump Line!



The Model S-12 Euclid-Easton hauler—with payload capacity of 44,000 lbs.—is a new size Euclid over-hung engine type semi-trailer rear-dump. Designed and built as a complete, balanced unit, it combines the experience of two leading manufacturers of hauling equipment for mines, quarries and heavy industrial and construction work.

With 218 h.p. and 5-speed gear transmission the S-12 has a fast travel speed and ample power for the toughest jobs. Big 24.00 x 25 tires on all wheels provide traction and flotation for operation under conditions that would stop other haulers. For work in close quarters the 90° hydraulic steering and variable wheel base gives the unit exceptional maneuverability and helps cut cycle time.

Well reinforced body is constructed of special alloy steel to withstand the impacts of shovel-loaded rock and heavy excavation. Single stage double-acting hoists raise the body quickly, with smooth positive control all during the dumping cycle.

Have your Euclid dealer show you how this Model S-12, or the 12 and 35 ton semi-trailer models with 143 and 325 h.p., can cut hauling costs. He'll be glad to tell you about other Rear-Dump "Eucs" of 10 to 50 ton capacity, too.

EUCLID Division of General Motors Corp., Cleveland 17, Ohio



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FOR MOVING EARTH, ROCK, COAL AND ORE

22-ton capacity

14 yds. struck

218 h.p.

24.00 x 25 tires

22.6 mph top speed



Euclid semi-trailer rear-dumps are available in 3 capacities—12, 22 and 35 tons with 143, 218 and 325 h.p. Tractors for these models are interchangeable on 7, 12 and 21 yd. scrapers.



Blasting costs cut 68%

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A prominent western company broke 23,000 cubic yards of waste limestone with only \$648 worth of blasting material. They used 13,000 pounds of USS Ammonium Nitrate (fertilizer grade) mixed with diesel oil; 300 pounds of gelatin powder (60% dynamite); 65 electric blasting caps. To do the same job, this company had previously used \$2025 worth of old-type blasting materials.

Here is how USS Ammonium Nitrate compared with the cost of other materials:

MATERIAL	COST PER 100 CUBIC YARDS OF LIMESTONE BROKEN
USS Ammonium Nitrate (compounded with diesel oil and 3% high explosive)	\$ 2.80
Nitro carbo nitrate (compounded with 27% high explosive)	8.00
Ammonia dynamites	10.60

USS Ammonium Nitrate gives excellent fragmentation. It is economical, safe and easy to use. For more information on how USS Ammonium Nitrate can bring similar savings to your blasting operations, write to United States Steel, Coal Chemical Sales, 919 Kearns Building, Salt Lake City, Utah.

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USS Ammonium Nitrate

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

March 1959

INTERNATIONAL PANORAMA

BISBEE, ARIZONA—Phelps Dodge Corporation is starting a \$5,000,000 program to expand the size of the Lavender open pit and almost double the life of the mine. Pit expansion will be largely to the south-east where drilling has discovered additional ore.

DAKOTA—Mines Development, Inc., operates of South Dakota's only east where drilling has discovered additional ore.

EDGEMONT, SOUTH DAKOTA—Mines Development, Inc., operators of South Dakota's only custom uranium ore mill here, have reported that 1,000,000 tons of ore is available from Black Hills mines for the enlarged 400-ton-per-day mill.

BAXTER SPRINGS, KANSAS—Several hundred acres of mining leases, south and west of here, have been purchased from the St. Louis Division of National Lead Company by the mining division of Eagle-Picher Company.

KELLOGG, IDAHO—Sidney Mining Company is starting deep development of the Nabob mine under a profit-sharing agreement with the Nabob Silver-Lead Company.

WASHINGTON, D. C.—Cia, Vale do Rio Doce, Brazil's largest iron mining company, has received an Export-Import Bank credit of \$12,500,000 to double high-grade iron exports from 3,000,000 to 6,000,000 annual tons.

GRANTS, NEW MEXICO—Rio De Oro Uranium Mines, Inc., will sink a 1,150-foot shaft and mine the uranium ore body of Parador Mining Company under an operating lease. This will be one of Ambrosia Lake's deepest mines.

ACEITILLAR, DOMINICAN REPUBLIC—The first shipment of bauxite ever made from the Dominican Republic was mined here by the Aluminum Company of America. Ore was shipped to the company's new Port Comfort, Texas alumina plant.

HOUGHTON, MICHIGAN—The Copper Range Company has offered to exchange mineral rights within the Porcupine Mountain State Park for State of Michigan mineral rights outside the Park. The Michigan Conservation Commission must rule on the exchange offer.

LIMA, PERU—Southern Peru Copper Corporation has been advanced a supplementary credit of \$15,000,000 by the Export-Import Bank of Washington to meet an over run in costs to bring the Toquepala copper mine into production. The bank had previously committed a \$100,000,000 credit to the company.

GRAND RAPIDS, MINNESOTA—Stripping operations have been started to bring the Lind-Greenway Mine into production as an open-pit mine in 1960. It will be operated by Jones & Laughlin Steel Corporation's Minnesota Ore Division.

SAN FRANCISCO, CALIFORNIA—An all-time monthly high output of 152,301 short tons of aluminum in the United States was set in December 1958.

MOSCOW, RUSSIA—Tin exports are to be limited to 13,500 tons in 1959, according to the head of the Russian Trade Delegation. Export quotas will be on the order of 3,000 tons to England, 4,500 to Netherlands, 3,000 to West Germany, 1,000 to Denmark, and 2,000 to Austria, Japan etc. Russian tin exports, about 15,500 tons in 1958, financially broke the International Tin Agreement.

HOYT LAKES, MINNESOTA—Erie Mining Company is expanding its taconite concentrator here by the addition of two new pelletizing experimental furnaces at a cost of \$4,000,000.

JADOTVILLE, BELGIAN CONGO—Union Minière du Haut Katanga has opened its Lupoto open-pit copper mine in order to increase native employment.

Anaconda Acquires Control Of Canadian Iron Deposits

The Anaconda Company, through a subsidiary, Anaconda Iron Ore (Ontario) Ltd., has taken over a 90 percent interest in a major iron ore deposit 100 miles north of Lake Superior in Ontario, Canada. The company is now proceeding with plans to mine 20,000 tons of ore this summer for shipment next winter after the freeze-up. The shipment will be used for a large-scale metallurgical test program.

The exact location of the property is given as 40 miles north of Nakina on the Canadian National Railroad. It has been reported that very substantial tonnages of low-grade open pit ore have been outlined in two separated magnetite deposits. Clyde Weed, president of The Anaconda Company, describes the magnetite as readily amenable to concentration to a product containing better than 65 percent iron. He also said that the ore occurrence is susceptible to the normal methods of magnetic concentration, and that the magnetite is much softer than Minnesota taconites. A good separation can apparently be made with a grind of 150 mesh.

Though Mr. Weed has said that it is not the intention of the company to bring this property into production at this time, Jack Knaebel, well known Anaconda mining engineer, was recently appointed president of the Canadian subsidiary, and is opening temporary offices at Port Arthur, Ontario, 150 miles south of the ore location. Persistent reports from Canada indicate that the property is undergoing close study, and that a major project may develop in the future.

Canadian reports describe the deposits as containing 28 to 30 percent soluble iron. They say that 200,000,000 tons of open-pit ore has been outlined in each of the two deposits which are about two miles apart. Present access to the property is by air, but construction of a winter road to the ore location is underway. During the summer, heavy equipment will be moved in to mine the 20,000 tons for test metallurgical study. Because work on process flowsheets can't get underway until this ore is shipped out in the winter, there will be a 2- to 3-year lag before any major construction could take place. A direct reduction process has been mentioned as a possible treatment method.

The Canadian National Railroad has completed a survey for a 40-mile branch line north from its Nakina divisional point to the property.

Anaconda acquired the properties from Lake Superior Iron and the Gourd-Riverin Syndicate, both of Montreal.

In April—How Hecla Used Steel Rings to Crosscut Deadman Shear

At Trout Lake: HMS Addition Rejects

The biggest Heavy Media Separation unit on the Iron Ranges was put into operation near Coleraine, Minnesota, by Oliver Iron Mining Division of U. S. Steel Corporation at the start of the 1958 season. Rated at 814 dry tons of feed per hour, the facility consists of two identical sink-float sections for treatment of ore in the minus-1½-inch, plus ¾-inch size range and two identical HMS cyclone sections for treatment of minus-¾-inch, plus-48-mesh ore. The new plant was built adjacent to Oliver's famous Trout Lake concentrator which, until the start of this year, was used primarily to beneficiate the fast disappearing, but higher-grade, sandy wash ores.

Today, the old wash plant has been modified to serve essentially as a pre-treatment installation for the HMS plant. It rejects coarse, low-grade chunks and minus-48-mesh fines from the feed to the heavy media plant. Certain portions or all of the washed product from the modified original plant, can be diverted to Oliver's shipping pocket if desired. From this point it can be loaded directly into railroad cars destined for lake ports.

Plant operation of the new HMS installation generally conforms to standard Iron Range practice. The unique features are the plant capacity provided, and the attempt to recover magnetite media used in the HMS cyclone circuit by simple drainage and washing of media from cyclone overflow on product screens. In most other plants the float product is put through a magnetic separator to recover the media. This feature is an apparent attempt to reduce separator capacity requirements which have shown a tendency to grow as lower grade ores are treated with a consequent need for cleaner media and higher separating densities.

Another apparent reversal of recent trends was the installation of classifying cyclones on the washed media to reduce the volume of pulp fed to magnetic separators. This represents still another attack on capacity requirements for magnetic separators in media cleaning circuits.

Another characteristic, taken for granted on the Iron Range, but found in few other mineral processing plants, is the complete absence of circulating loads within any circuit. A middling product is unknown, and feed travels straight through the plant from ore car to either concentrate storage or waste.

The coarse fraction of the feed to the HMS plant is treated in 10- by 10-foot drums. These units just about double the capacity provided by the more conventional 8- by 8-foot drums which are more widely used in the Mesabi district.

Why Plant Was Installed

The new HMS plant has made possible a reduction in the silica content of the product shipped to lower lake ports from 13 or 14 percent SiO_2 to 9 or 10 percent SiO_2 . This was the major consideration that went into the decision to construct the new HMS addition. Oliver's new plant is significant, not because of unusual design or practice, but because its construction was prompted by the two factors which dominate today's iron ore picture:

1. Dwindling reserves of high-grade ore, and
2. The demand by blast furnace operators for ores of superior physical, chemical, and structural characteristics. It was once estimated by a well-known authority that a reduction in silica content of the concentrate by 1 percent made possible a saving in furnacing charges of \$0.75 per ton of feed.

In many respects Oliver's new Trout Lake facility lends official recognition to the above two factors, because it was the first commercial-scale plant to treat iron ore. It was put into operation in 1910 following extensive research and test work to develop suitable equipment and processing methods. The painstaking care with

which Oliver's pioneer engineers did their original development work is proven by the fact that the plant operated successfully for 15 years without any basic changes in flowsheet or machinery. Since 1910, Oliver's Trout Lake plant has been the largest on the Iron Ranges until completion of the new taconite plants just recently. The plant has processed 130,361,818 tons of crude ore to the end of 1957 from which 80,336,759 tons of concentrate has been recovered.

Wash Ores Disappearing

In recent years, however, the changing ore reserve picture was altering processing requirements. In 1954, the two units of the Trout Lake wash plant were treating ore at the rate of 1,250 tons per hour. One unit, with a capacity of 700 tons per hour, was equipped with log washers and was suitable for beneficiating standard wash ores. The second unit was equipped with a rod mill, screens, and classifiers, thus it could handle off-grade wash ore that required a finer grind. The capacity of the second unit, however, was only 550 tons per hour.

At the start of the 1954 season Oliver's western Mesabi ore reserves consisted of 35 percent standard wash and 65 percent refractory or treated ore. This ratio was just the reverse of that which had prevailed years ago. Gradual depletion of the high-grade wash ore left the Trout Lake plant with two circuits offering capacities exactly opposite to future ore processing requirements. Since the proportion of standard wash ore would be diminishing more rapidly in the future, a change was in order. By this time heavy media separation had become a well accepted tool for beneficiating off-grade iron ores, and had demonstrated its usefulness at many commercial installations on the Iron Range.

Pre-Treatment

Crude tonnage delivered to the plant is still handled at a rate of about 1,600 tons-per-hour. About 50 to 60 percent of the wash plant product now reports to the new HMS plant. Most of the reject from the washing plant is a minus-48-mesh product which overflows classifiers at the tail end of the wash plant circuit. About 2 percent of the incoming feed is scalped out at a relatively coarse size (plus-8-inches), crushed and rejected to a rock dump.

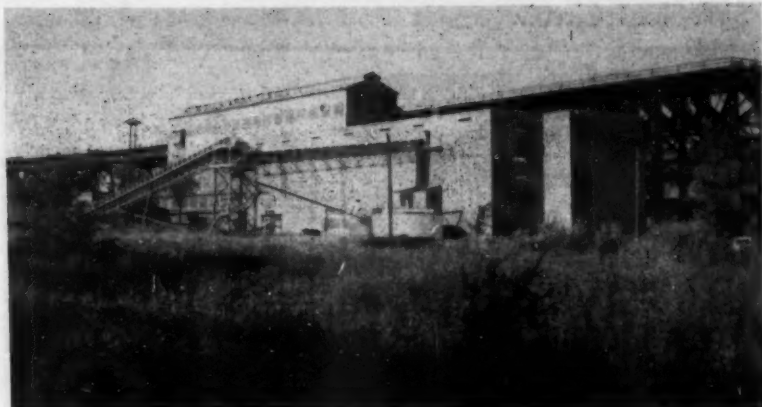
Ore is transported to the mill by 30- and 40-yard side dump cars (ore

Operating Manpower Requirements Trout Lake Concentrator Per Shift

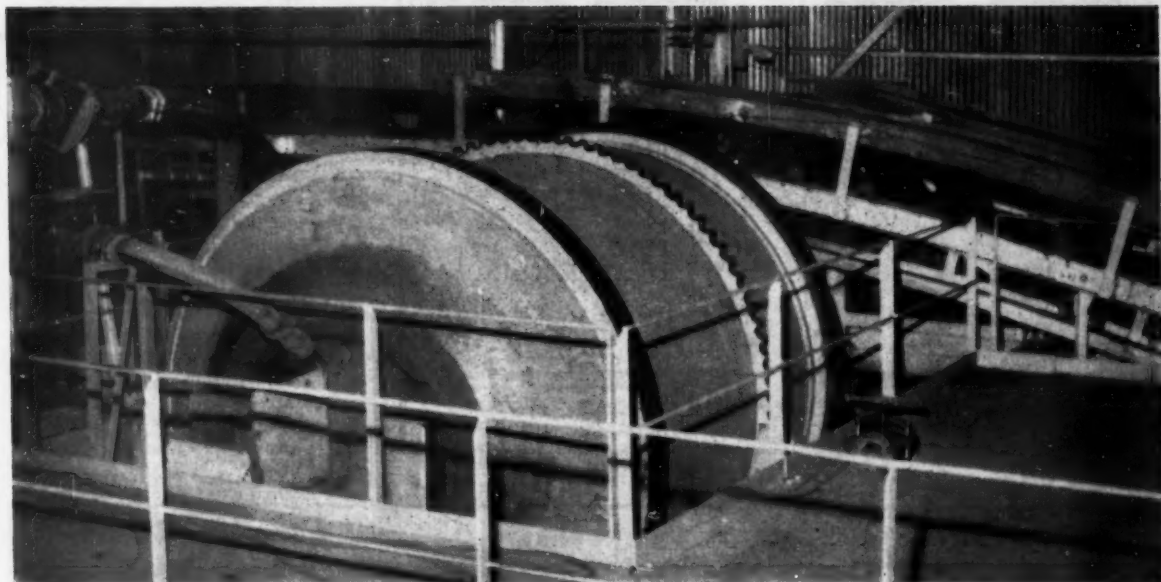
1 man each crusher plus oiler	3
Jaw crusher operator	1
1 operator per wash unit	2
Scaleman & Crude ore man	1
Dumpman	2
Binman	1
Car riders	3
Car loader	1
HMS operators	2
HMS helpers	2
General labor	5
Watchman & dryman	1
Sample grinder	1
Plant boss	1
Stacker operator	1
Total	27

More Silica

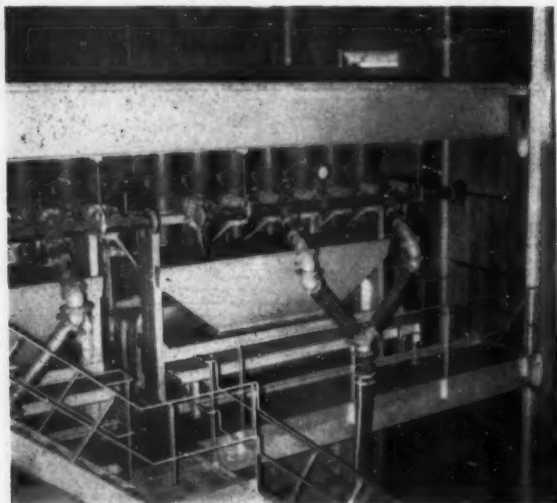
Oliver can now feed
lower grade ore to
its historic plant



For coarse ore: Drum separators



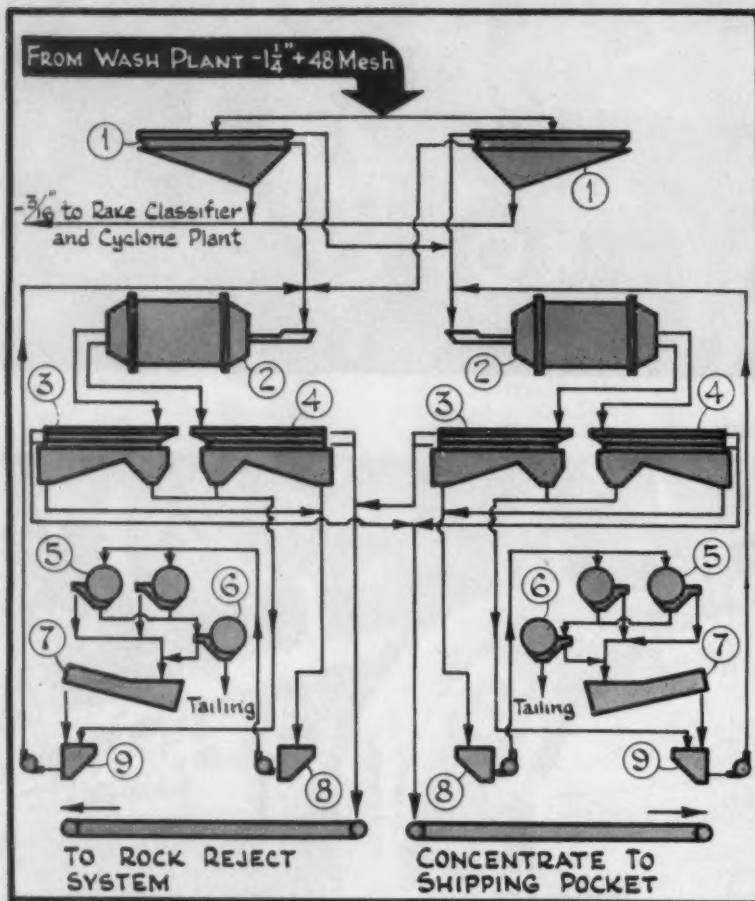
For fine ore: HMS cyclones



Result: A cleaner product



Sink-Float Circuit



factor is 2 tons per yard). Trains are composed of 1200-horsepower Diesel locomotives and 7 to 9 cars. The incoming ore cars travel over a trestle spanning two 600-ton bins. Each bin feeds one section of the pre-treatment or wash plant. Each of the two circuits in the pre-treatment plant are nearly identical, with the exception that Unit No. 2 is equipped with log washers while Unit No. 3 is not. In each, the ore is fed by a 72-inch pan feeder to heavy-duty, double-deck screens. The top deck oversize (plus-8-inches) from each plant section is pan conveyed to

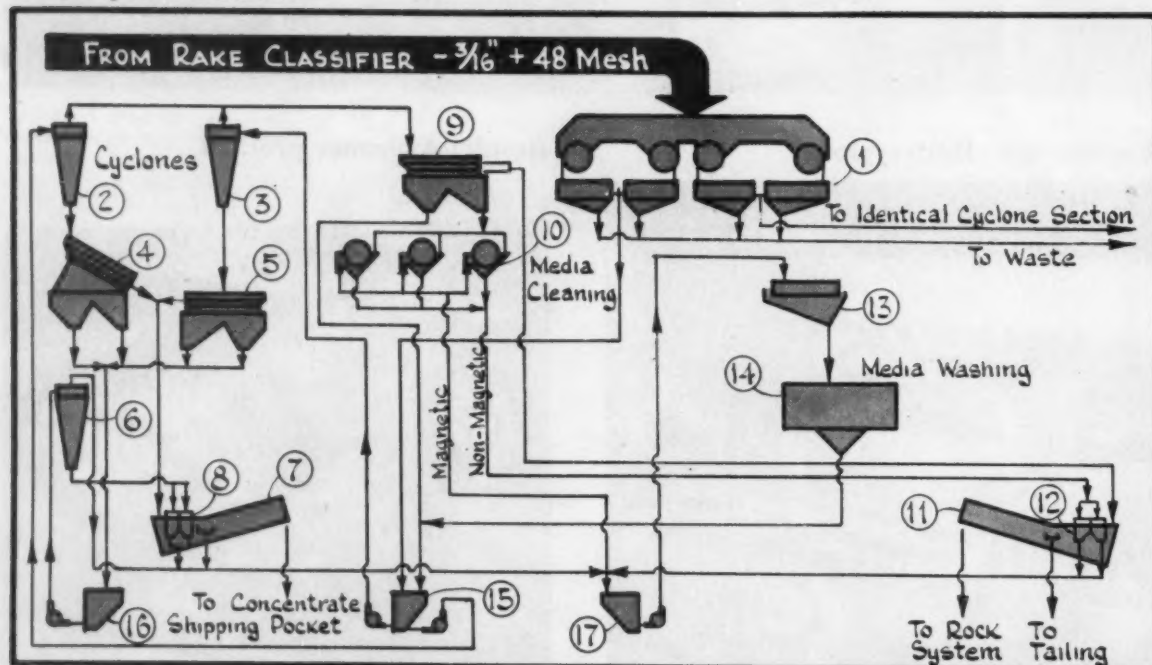
Sink-Float Circuit

1. 6-by 20-foot screens
2. 10-by 10-foot drum separators
- 3 and 4. 6-by 20-foot product screens
- 5 and 6. Magnetic belt separators in media recovery circuit.
7. Spiral densifiers
- 8 and 9. Media pumps

HMS Cyclone Circuit

1. Roll feeders and screens
- 2 and 3. Seven 10-inch cyclones
- 4 and 5. Underflow screens
6. Three scavenger cyclones
7. Spiral densifier
8. Magnetic separators
9. Cyclone overflow screens
10. Magnetic separators
11. Spiral densifier
12. Magnetic separators
13. Chip screen
14. 30-foot thickener
- 15, 16 and 17. Pumps

HMS Cyclone Circuit



a single jaw crusher where it is broken to minus-5-inch size and conveyed to the rock dump.

To compensate for lack of log washers in Unit 3, the bottom deck of the primary screen at the head of that circuit contains 1½-inch openings; the bottom deck of Unit No. 2, the circuit that contains log washers, passes 2½-inch material. The intermediate size range in both circuits (bottom deck oversize) is then screened and fed to 4½-foot crushers. The use of primary screen with smaller bottom deck openings in Unit No. 3 is obvious. Unit 2 is the more efficient scrubbing circuit because it contains log washers. To get the same effect in Unit No. 3, a greater proportion of the feed must be split out to the secondary crusher in order to achieve greater liberation of iron minerals from silica and other gangue minerals.

In each circuit the minus-½-inch fines are fed to rake classifiers for removal of slimes and clay. The rake classifiers produce overflows that report to tailing and sands that join the coarse wash plant product on a conveyor leading to HMS storage facilities.

Sink-Float

Five surge bins, each with a capacity of 750 tons, serve the HMS plant. The conveyor system leading from the prewash plant discharges the HMS feed to a 65-foot-long, 42-inch-wide shuttle conveyor which loads each of the bins. Each bin is discharged by means of reversible belt feeders. When the belt feeders travel in one direction, the ore enters a conveyor system leading to the HMS plant. By reversing the belt feeders, pre-wash ore may be directed to a conveyor system leading to the concentrate shipping pockets.

Feed to the HMS plant is split to two, 6- by 20-foot, double-deck preparation screens. The bottom deck of both screens passes a minus-¾-inch product which gravitates to classifiers in the cyclone feed preparation circuit. Bottom deck oversize and top deck oversize are conveyed to the two sink-float circuits which are identically equipped with a drum separator, two product screens, and a media recovery circuit. All ore introduced to the sink-float section is plus-¾-inch size, and separation is carried out in ferrosilicon suspensions in the drums. Two feed options are available. (1) the top deck material (plus-¾-inch size) of both preparation screens can be fed to one sink-float circuit, and the bottom deck oversize (plus-¾-inch, minus-½-inch) can be directed to the second sink-float section; or, (2) the top deck and bottom deck oversize of each preparation screen can be combined, forming the

feed for a sink-float circuit.

Under the first arrangement, each sink-float separator treats material that is sized to relatively narrow limits, and media density in each can be adjusted to optimum conditions. This may result in the production of a higher grade concentrate and better recovery of iron in some refractory ores. For example, when a sized feed is treated by sink-float, a high media density of 3.2 or 3.3 may be required to make an acceptable concentrate from the coarse fractions of some of the refractory ores containing silica that is intimately interwoven with iron minerals. This high media density, however, could result in the loss of some hematite fines, were it used in the second or fine circuit. On the other hand other ores may not require this sizing where good liberation of the ore from the gangue occurs at a relatively coarse size, and the second feed alternative mentioned above offers the advantage of uniform operating characteristics in both circuits, thereby minimizing operator supervision.

Product Handling

The discharge of the drum separators is handled by two double-deck, 6- by 20-foot screens in each circuit. The product screens contain a 5-foot drain section and a 15-foot-long wash section. The sink material traveling to the end of the product screens enters the conveyor system which delivers concentrate to the shipping pockets. The float discharged from the product screens reports to a conveyor system leading to the rock dump. Free draining media recovered from the first 5-foot section of the product screens is returned to the drum separators by a pair of 6-inch pumps.

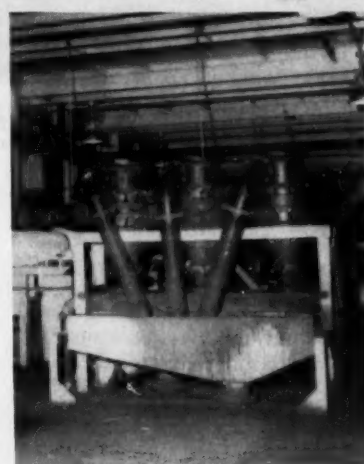
Contaminated media collected from the spray-equipped wash sections of the product screens is pumped to a media cleaning circuit. The latter consists of two magnetic belt separators which serve as primaries and a secondary magnetic belt separator which scavenges the primary tailings. The magnetics from all three separators are collected in a 54-inch densifier. The thickened media passes through a demagnetizing coil before being returned to the 6-inch pump which introduces the ferrosilicon suspension to the heavy media vessel. The densifier overflow is recirculated to the head of the cleaning circuit.

Ferrosilicon Density

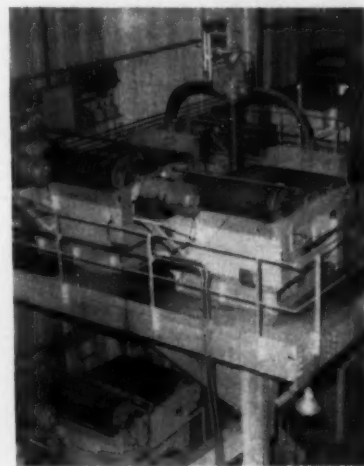
Control of media density rests at the densifier and specific gravity is determined manually. Depending on the type of feed, density of the suspension may vary from 3.0 to 3.3. If a free silica ore is being handled, a media density of 3.0 or 3.2 will produce an



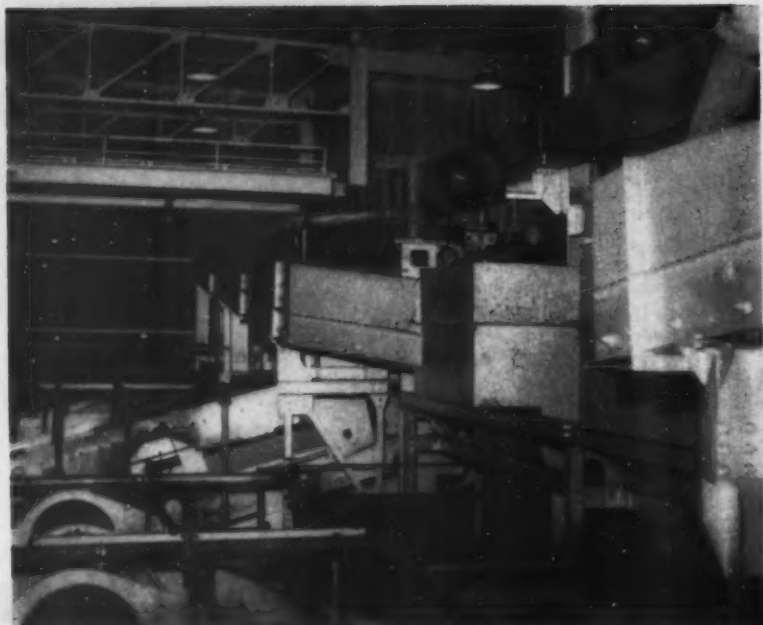
FLOAT from drum separators is washed on 6- by 20-foot screens; sink is handled on similar screens.



MAGNETITE washed from screens in the cyclone circuit is fed to a set of three, 15-inch classifying cyclones.



THREE BELT SEPARATORS recover media in each sink-float circuit; two upper units are primaries and the other a scavenger.



CYCLONE PLANT consists of four banks of cyclones with 7 units in each bank. Each bank is fed by a five-inch pump and overflows and underflows are taken on 6- by 16-foot screens. A magnetite media is used in this circuit.

acceptable concentrate. If a great deal of locked silica is contained in the ore, a density of 3.3 may be needed.

In the future, still higher media densities will likely be required, not only at Oliver, but at other Mesabi operations as lower grade ores are treated. Some of the lower grade, refractory ores can only be up-graded to 48 percent in a separating suspension with a density of 3.3. For this reason, many producers are testing spheroidal ferrosilicon made by a German firm. It is felt that the tiny, smooth surfaced beadlets will yield a suspension that has a higher specific gravity without consequent increases in viscosity. Furthermore, this type of media will probably lend itself to better recovery, thereby reducing media losses.

Magnetite Media For Cyclones

As mentioned previously, the cyclone circuit is somewhat unique in the manner in which media is recovered from cyclone underflow and overflow products. In the cyclone circuit, separation is carried out using a locally produced magnetite media prepared from taconite concentrate. It has a dry specific gravity of 4.5 and screens 75 to 85 percent minus-270-mesh. Recovered and make-up magnetite is fed into the cyclone circuit from thickeners. The thickener underflow has a density of 2.6, but this is diluted with intermediate return media so that the effective density for separation is 2.4.

Ore entering the cyclone section of the plant consists of the minus- $\frac{3}{16}$ -inch undersize taken from the sink-float preparation screens and de-watered in rake classifiers. The classifiers overflow to waste and the sands are conveyed to a surge bin serving the cyclones. The surge bin is unloaded by means of four roll feeders that distribute the feed to four, 5- by 14-foot, double-deck screens. The bottom deck undersize (minus-0.6-millimeters) is pumped to tailings. The oversize from two of the screens is the fine ore that is fed to one of the two identical cyclone sections. A description of one section will serve for both.

Separation

The ore and return cleaned media are introduced to a common sump which feeds two 5-inch sand pumps. Each pump delivers the pulp through a master manifold to one of two banks of seven 10-inch cyclones. The cyclones contain Ni-Hard liners and the feed pressure varies from 22 to 24 pounds per square inch. Two stepped-deck, 6- by 16-foot screens handle all cyclone underflow. Each screen takes the underflow from one bank of the cyclones. The screens have a drain section and a wash section. Media recovered in the free draining section is returned to the cyclone feed sump. The undersize material collected in the wash section is classified in a set of three 15-inch cyclones. The cyclone overflow enters the media thickening system. The cyclone underflow reports

to a pair of separators mounted on the pool end of a classifier. The magnetics are collected for recirculation to the media thickening system. The feed to the classifier consists primarily of the oversize from the sink screen, along with any non-magnetics dropped out by the two magnetic separators. The classifier overflow returns to the media thickening circuit and the product is a finished iron concentrate which is delivered to the shipping pockets.

Cyclone Overflow

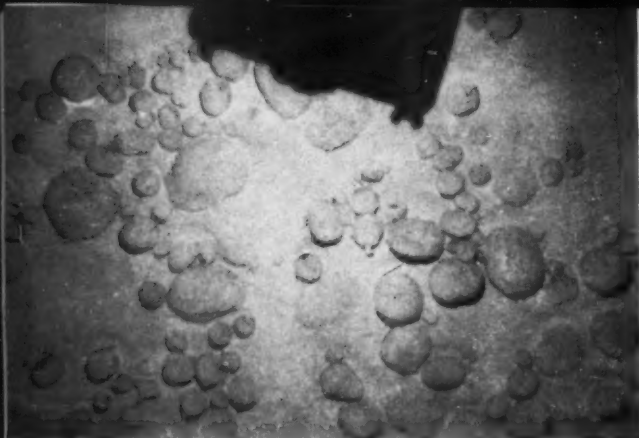
The overflow of the two banks of primary cyclones is combined for delivery to a single, 6- by 16-foot, screen equipped with free drain and media washing compartments. The bulk of the magnetite suspension (75 to 80 percent) introduced with the cyclone feed reports with the overflow product. The screen undersize collected in the free draining section of this screen is returned directly to the primary cyclone feed sump. The undersize gathered from the wash section is split between three drum separators. The magnetic product of the separators is circulated through the media thickening system; the non-magnetics from the separators are scavenged in a set of two separators mounted in the pool of a classifier that receives the oversize material discharged from the cyclone float screen. The magnetics recovered at this point enter the media thickening system. The classifier sands report to the rock waste system and the overflow goes to tailing.

Make-up magnetite and the media recovered by magnetic separators are pumped to a chip screen for removal of tramp non-magnetic material, and the undersize is delivered to a 30-foot-diameter thickener. The thickener underflow is pumped back to the primary cyclone feed sump.

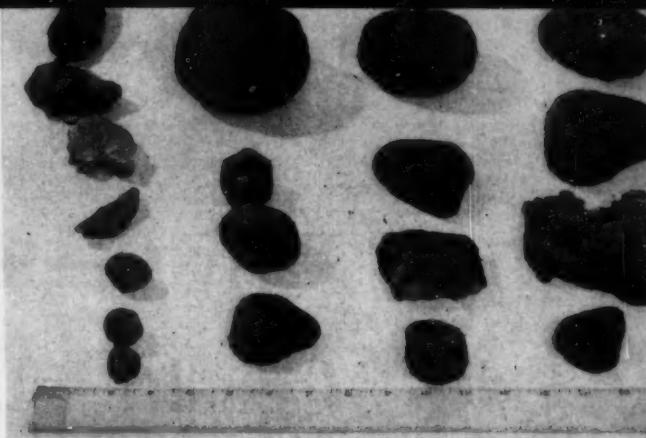
Oliver's expanded plant treated ore containing an average of 42 percent iron and 36 percent silica during 1958. The concentrate produced averaged 57 percent iron and 12.5 percent silica, with a weight recovery of 42 percent. During the 1957 season, when washing was the only beneficiation carried out at Trout Lake, Unit No. 2 of the plant was operated with a feed of 42 percent iron and 34.3 percent silica. The concentrate averaged 55.1 percent iron and 14.3 percent silica. In the same year Unit No. 3 made a 54.6 percent iron concentrate containing 15.6 percent silica with a weight recovery of 40.8 percent.

The new HMS additions have enabled Oliver to treat a lower grade ore and, at the same time, to recover a higher grade concentrate containing less silica. The famous Trout Lake concentrator has passed another milestone in its long history.

THE END



TOMORROW'S MANGANESE ORE looks like this on the bottom of Atlantic Ocean east of Bermuda. It's deeper than the deepest mine 18,000 feet. David Owen of Woods Hole Oceanographic Institute took picture. Note camera shadow.



ONE DREDGE HAUL brought up this assortment of nodules; actually there were about three times as many, but they aren't all in picture. Tonnage estimates for mineable nodules range into hundreds of billions of tons. Ruler gives size.

Will Deep Sea Bottom Make Tomorrow's Manganese Mines?

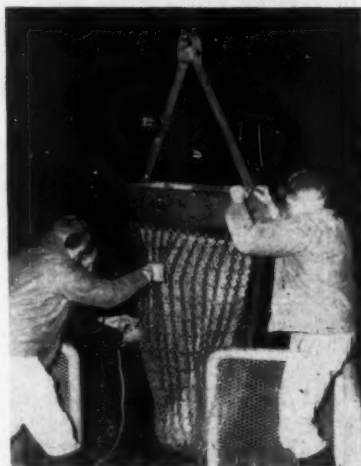
By **JOHN L. MERO**

Some of the nation's largest mining companies have already taken a look at deep undersea mining of manganese-iron nodules with appreciable cobalt, nickel, and copper content. There's every indication that there are vast tonnages available; much of it, however, at great depth off the southeastern United States coast, off the Pacific coast, and at the bottom of the Pacific Ocean between South America and Tahiti.

Milling and refining apparently present no great problems; that's one reason why Union Carbide Corporation, Freeport Sulphur Company, and Sherritt Gordon Mines Ltd. have been interested. They already have operational experience at plants using a similar flowsheet to that indicated necessary to mill the undersea material. American Metal Climax, Inc., Utah Construction Company, and the Convair Division of General Dynamics Corporation have also shown interest in these deposits.

Although the existence of small, brown-black concretions of manganese dioxide on the floor of large areas of the world's oceans has been known for almost 85 years, only recent dredge hauls from comparatively shallow waters have warranted an engineering study of the technical and economic aspects of mining and processing this material. This study has been sponsored by the University of California's

Mr. Mero is a graduate research engineer at the Institute of Marine Resources Mineral Technology, University of California, Berkeley, California.



ROCK DREDGE being lowered from ship for deep ocean sediment sampling.

Institute of Marine Resources. Here are some highlights and conclusions from my long report, soon to be published, on "The Mining and Processing of Deep-Sea Manganese Nodules".

An average grade of this material dredged up from all over the world is 20 percent manganese, 15 percent iron, and 0.5 percent each of nickel, cobalt, and copper. Locally the nodules grade as high as 45 percent manganese, 1.0 percent cobalt, 1.4 percent nickel, and 1.8 percent copper, not all in the same nodule, however.

The cost of mining the nodules should be about \$5.00 a ton depending on the depth and concentration of the deposit. If deep-sea hydraulic dredging proves technically feasible,

mining costs could be as low as \$2.00 per ton of nodules recovered, depending on the depth of dredging.

The cost of transporting the nodules from the mining site to a seaport processing center will range from \$1.00 to \$8.00 per ton of ore depending on the distance of the haul. Because deep-sea hydraulic dredging unit costs are almost independent of the depth of dredging, a minimum charge for transport costs can be assumed; deposits of the nodules occur within several hundred miles of either coast of the United States.

The capital investment in mining and processing systems can be expected to be about \$10,000,000 for a 500-ton-per-day operation or about \$60,000,000 for a 5000-ton-per-day operation.

The nodules are related to a variety of manganese ores known as wad or bog manganese. Because of the intimate relationship of the various elements in the nodules, there is little chance of upgrading the nodules by any process, such as flotation. Preliminary hydrometallurgical experiments indicate that any of the processes developed for winning manganese from low-grade domestic ores should work satisfactorily from a technical standpoint in the recovery of manganese from the nodules. It is relatively simple to dissolve the nickel, cobalt, and copper in the nodules once the manganese is made soluble by a reduction process. The processing costs of a ton of average grade nodules can be expected to be about \$22.00. The gross value of the recovered metal products at September 1958 prices will be about \$43.00.

Should commercial mining of this material prove feasible, the present state of ocean law would lead to no end of legal complications. An International Ocean Mining Law is needed before this happens.

Why Germans Crush Potash by Impact

This is the second and final part of an article on German potash crushing practices. The first section in the February 1959 issue of MINING WORLD described impact crushers and gave figures for energy consumption in crushing.

By Dipl. Ing. KURT SCHMIDLAPP

The results obtained at the Neuhoef-Ellers mill, with crude salt in occlusion with clayey material, demonstrate quite clearly the selective action of the impact crushers. This property has proved particularly effective in ore-dressing practice, when the feed is composed of heterogeneous material. The importance of these conclusions is that henceforth hand-picking, above or below ground, for at least

Mr. Schmidlapp is managing director of the Neuhoef-Ellers potash mine in West Germany. This was first mine to adopt large-scale flotation of kieserite-bearing potash salt.

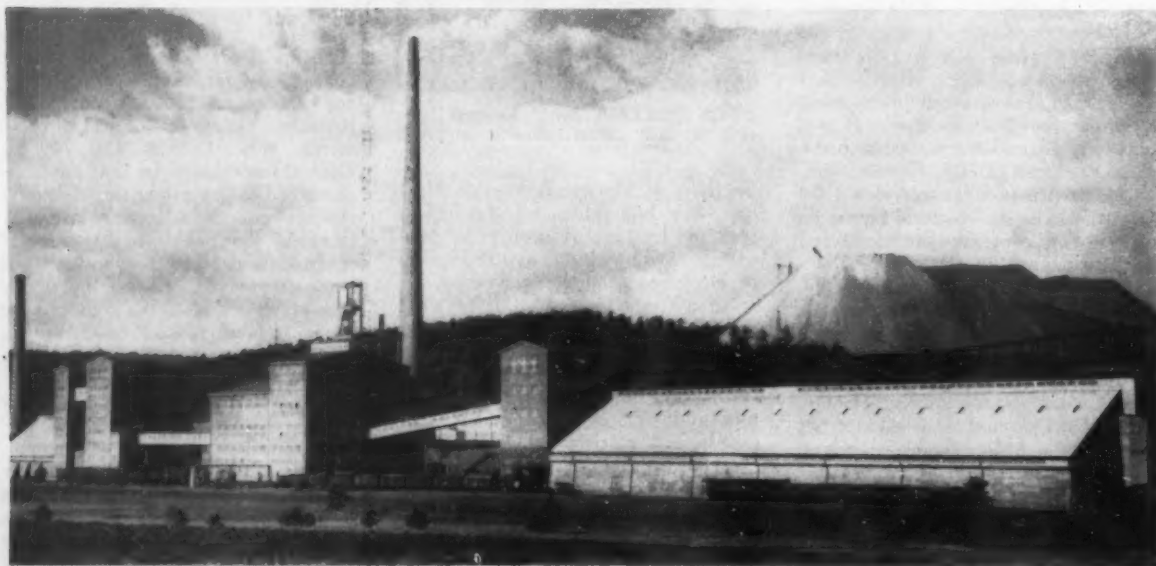
partial elimination of slime-forming clay components can be dispensed with when selective crushing is carried out in combination with another dry type separation process.

Reference to the Distribution Curve of Air Separated Grit Components will show that, as a result of the selective crushing action of the AP 4 Br. impactor, a considerable beneficiation of clay occurs, running as high as 10 times the average value of the total throughput, especially in the 4-mm fractions. By installing several crushers in tandem, with proper choice of impact speed and gap distance, in combination with intermediate stage-screening, it is possible to improve selectivity with a consequent increase in the quantity of low-grade clay eliminated prior to treatment by flotation. In this respect, tests are still being conducted and appear very promising. A further point of interest is hand-picking of boracite lumps fol-

lowing selective crushing, as practiced at another plant.

In contrast to crude salt-Kainit* reduction which is carried out regardless of grain preservation, the 0.06-0.6-0.75 mm particle range specified for salt flotation is more difficult to obtain, especially since, in the interest of a granulated end product, the medium-size range must lie more in the region of the upper limit. The solution of these problems involved extensive tests with fast-running dry and, partially, wet operating mills, in addition to ball and wet rod mills. No consideration at first was given to impact crushers, because it was assumed the limited size of the feed would not

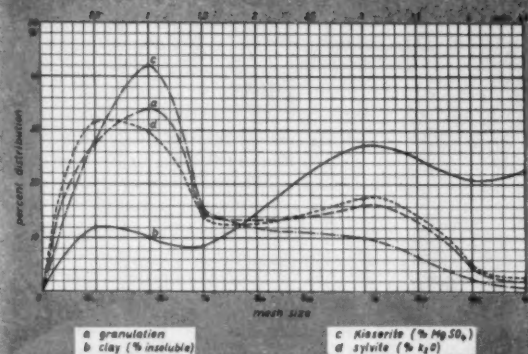
*Kainit is a crude salt used as a fertilizer without processing which contains a certain percentage of magnesium sulphate; originally a potassium mineral. Other minerals and terms used in these articles are: Hartsaltz, Kieserite-bearing crude salt. Kieserite is $MgSO_4 \cdot H_2O$. Kainit-Hederich, crude salt as before, but pulverized. It is used to kill weeds; in particular, charlock (*raphanus raphanistrum*).



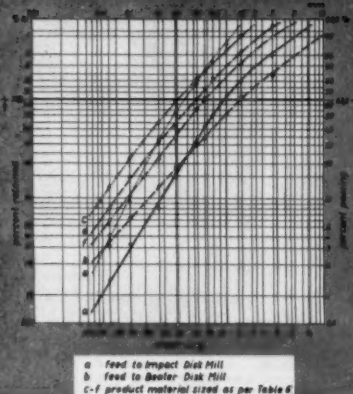
CONSTANT DENSITY flotation feed is obtained at the Neuhoef-Ellers potassium chloride flotation mill of Wintershall A. G.

by a two-section crushing plant. One section is dry-impact, the other wet. Products are proportioned for uniform feed.

Distribution Curve of Air Separated Grit Components



Particle Size Distribution Curve of Hartsaltz After Fine Crushing



develop the necessary kinetic energy.

The fast-running mills were tested on hartsaltz ground in one pass; as anticipated, the product size fell somewhat short of theoretical expectations. This is understandable when it is considered that the mills (e.g. pin beater mills, beater disc mills, Teutonia mills, and a variant of the latter) generally produced an inordinately high proportion of 0.06-mm undersize on the one hand, and on the other, too much oversize as a result of decreasing speed, with a correspondingly lower finished product capacity. The use of the previously mentioned impact disc mill available from Messrs. Pallmann of Zweibrücken/Palatinate appears a better practice in that its performance approaches more closely the required conditions. Employing a principle similar to that underlying the "orthodox" impactor, this mill does practically all of its crushing through impact, the feed being hurled by an impeller onto a counter-rotating disc. The Particle Size Distribution Performance Curves for this dry and wet operating grinding machine and, by comparison, those typically representative of high-speed pulverizers, namely the dry-grinding disc beater mill manufactured by Condux, Wolfgang near Hanau, are shown. The operating data relating to these two types of mills are shown in Table No. VI. As the impact disc mill requires two motors to drive the impeller and the counter-rotating disc, the specific power consumption per ton of salt milled is in excess of that usually required for most of the other commoner types of high-speed pulverizers. Impact disc mills, naturally, require a higher energy input when performing wet; also more grain-preserving crushing is obtained because of simultaneous acceleration of

the saturated brine. However, the slight power disadvantage is largely compensated for by the economical operating characteristics because the wear costs are substantially lower when compared with those of all the other high-speed mills investigated. Incidentally, impact disc mills are used for reducing salt. In the Neuhofer-Ellers flotation plant they are employed for secondary reduction of the intermediate sized material in closed circuit, in accordance with the characteristics (curve e) shown in the Particle Size Distribution Curve Graph.

The use of high-speed pulverizers arranged in circuit with classifiers is, as we have seen, capable of grain-preserving reduction and is becoming a well standardized fine crushing practice. It is possible, by properly adjusted speeds, to regulate the ratio of reduction quite closely to the desired degree of fineness, with the oversize from the classifier returning to the mill for further reduction.

In a series of tests, part of the Kainit-crude salt ground to minus-4-mm in a large size AP 4 Br. Hazemag impactor was sent to the Hildesheim pilot-plant. The accompanying flowsheet shows it uses a primary screen, an air separator with a secondary screen, and the investigated pulverizer arranged in circuit with a bucket-elevator. The circulating load "A" which depends upon the degree of size reduction is a multiple of the volume of the fine particles leaving the separator and can be calculated from the percentage of fines (minus-0.6-mm) of the circulating load by a well-known equation, where:

G = feed material to separate with g percent fine particles
F = material leaving separator with f percent fine particles
A = circulating load with b percent fine particles prior to entering pulverizer and with a percent fine particles upon exit from pulverizer.

$$\text{Hence, } A = F \cdot \frac{f - g}{a - b}$$

With feed entering Mill direct:

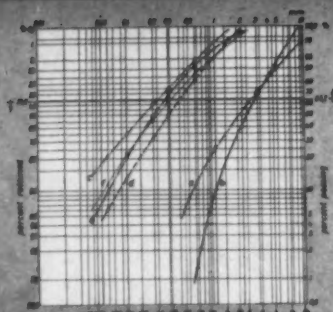
$$A = F \cdot \frac{f - a}{a - b}$$

Table No. VI
Results of One Pass Pulverization Tests on Hartsaltz
With Impact and Beater Mill Discs

	Impact Disc Mill PP 6	Impact Disc Mill PP 6	Impact Disc Mill PP 6	Beater Disc Mill CSS 350 H
Crushing mode	Dry	Dry	Wet	Dry
SPEED (RPM)				
Beater disc ¹	2,300	2,000	2,000	2,000
Impact disc ²	950	700	700	—
Gap distance (mm)	1.0	3.0	3.0	—
Throughput (tons per hr.)	4.7	6.8	3.4	6.75
Driving power (kw)	25	30	23	14.2
Specific power consumption (kw/hr per ton)	5.32	4.41	6.78	2.10
FEED (percent)				
Minus-0.6-mm	43	43	40	35
Minus-0.06-mm	1.5	1.5	2.5	3.5
Size Distribution Curve	c	d	e	f
PRODUCT MATERIAL (percent)				
Minus-0.6-mm	86	74	88.5	64
Minus-0.06-mm	12.5	7.5	4.0	5.8
Absolute increase in extreme fines (percent)	11.0	6.0	1.5	2.3
Ratio of reduction (percent)	1:2.9	1:2.0	1:2.6	1:1.7
Crushing progress (percent)	75.0	54.4	76.0	44.6

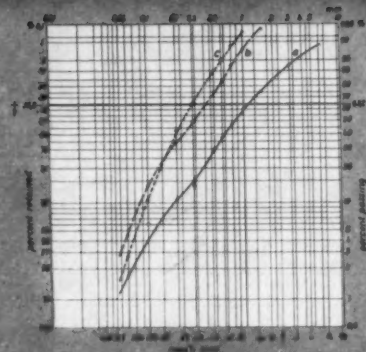
1. Diameter of impeller 565 mm, diameter of beater disc mill 350 mm.
2. Diameter 600 mm.

Dry Fine-Crushing Curves on Hartsaltz with High Speed Mills in Closed Circuit



a feed to Teutonia and Beater Disc Mill
b feed to Pin Beater Mill and Impact Crusher
c product material from Teutonia Mill
d product material from Beater Disc Mill
e product material from Pin Beater Mill
f product material from Impact Crusher

Hartsaltz Wet Fine Grinding Curves with Rod Mills and Classifiers, Followed by Recrushing in Impact Disc Mills



a feed material to rod mill
b classifier overflow (finished product)
c recrushing in Impact Disc Mill

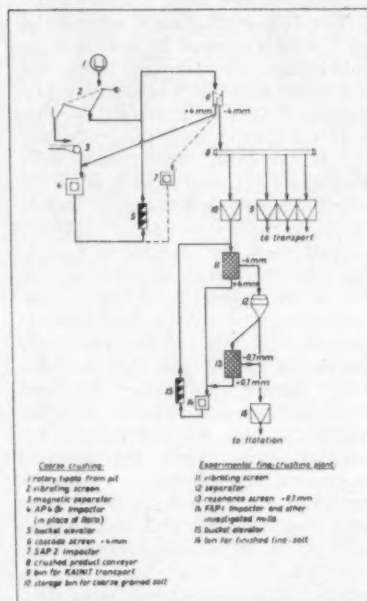
The circulating loads determined as a function of the speed and the specified end fineness run as high as 1.4 to 4.5 times the fine particles leaving the separator. To relieve circulation, the air-separated grit was, incidentally, re-treated on a resonance screen. The results of these pulverizing tests are shown partly in Table No. VII and partly in the graph showing Dry Fine-Crushing Curves on Hartsaltz With High Speed Mills in Closed Circuit.

Thus, both the beater disc mill and the Contraplex mill (Alpine, Augsburg)—the latter powered by two electric motors—deliver a more or less properly sized product, while the Teutonia mill, by comparison, produces more superfines. Hence it follows that however much, even by working in closed circuit, the specified grain range was improved in both directions, the desired accuracy is still far from being realized. This means that to avoid superfines it is advisable to accept oversize material and to re-crush as an intermediate product after flotation.

Another important point is that nearly all high-speed mills have the great disadvantage that they are vulnerable to tramp iron; also that their wear costs are extremely high. For

hartsaltz, these costs are quoted as averaging between 4.75¢ (U.S.) and 19.0¢ (U.S.) per ton of product material.

In the Dry-Fine Crushing With High Speed Mills Graph, the curve "f", relating to a Hazemag FAP 1 high-speed impactor evolved especially for fine-crushing, is of particular significance in that it practically coincides with that obtained from the other high-speed mills previously investigated. This small-size impactor, though at first excluded from the test work on the assumption that it was not suitable on account of the fine-grained feed material, proved nevertheless capable of delivering—with a minimum of power consumption—as much as 5 to 7 tons per hour of a product having a size distribution according to curve "f". Here again, efficient dust control is essential to prevent air cushions which are liable to impair the crushing effect. So far, fine-crushing in closed-circuited impactors had to be limited to small-scale tests, since larger FAP units, with capacities to suit large plant requirements, were not available. However, finality with dry operating pulverizers working in closed circuit has not yet been experienced, the importance of this conclusion being that



Flowsheet, Hildesia Crushing Plant

it opens up a very wide scope for developments and improvements in the efficiency of fine crushing equipment.

What Tests Showed

From an economic standpoint, therefore, it was decided after experimenting with the less promising method of dry ball milling to change to the more grain-preserving wet rod milling process, in closed circuit with spiral or rake classifiers. Used with sylvite at first in the Friedrichshall potash operations, this process proved inadequate for straight application on hartsaltz, as the prolonged retention of the Kieserite crude salt in the brine offers too great a risk of loss through

Table No. VII
Performance Data of Dry Pulverizing Tests
On Hartsaltz in Closed Circuit

	Teutonia Mill With Screen	Beater Disc Mill CSS 650 II	Pin Beater Mill Contraplex 630 Co	Impact Crusher FAP 1
Manufacturer	Wedag, Bochum	Condux, Hanau	Alpine, Augsburg	Hazemag, Munster/W.
Circumferential speed (rpm)	1,575	950	3,000/2,000	42 meters per sec.
Throughput (tons per hr)	5.0	8.01 ¹	5.6 ¹	5.5
Specific energy consumption (kwhr per ton)	5.3	3.4	4.3	3.1
Size Distribution Curve	c	d	e	f

1. Beater disc and beater mill were both fed below their normal rating

conversion into double salt if brining lasts longer than activating the Kieserite component. Considerable test work was carried out with a 10-ton rod mill (manufactured by Krupp/Rheinhausen) to ascertain the working scope related to both the composition and the direction of flow of the brine, and the design finally adopted for the hartsaltz fine grinding section employs two, 1.88-meter-diameter rod mills which, inclosed circuit with spiral classifiers, rotate at 70 percent of their critical speed.

The following constitutes a survey of the factors which have been found, after careful investigation, to bear on both the grinding process and the degree of size reduction:

Pulp density of the feed material.
Relationship between the volume of grinding media and the volume of the mill.

The rod charge.

Diameter of rods (40 to 85 mm) and diameter-ratio of the unequally sized rods.

Speed of mill.

The graph, Hartsaltz Wet Fine Grinding Curves With Rod Mills and Classifiers, Followed by Recrushing in Impact Disc Mills, gives an idea of the grinding results obtained with the Neuhof-Ellers rod mill at the classifier overflow. This normally contains as much as 15 percent of oversize material with a slight increase in the proportion of fine particles in the overflow, which, after flotation, is returned to an impact disc mill for further reduction.

It will be gathered from the foregoing that, so far as hartsaltz fine grinding prior to flotation is concerned, the combined use of dry impact crushing and wet rod milling with the over-



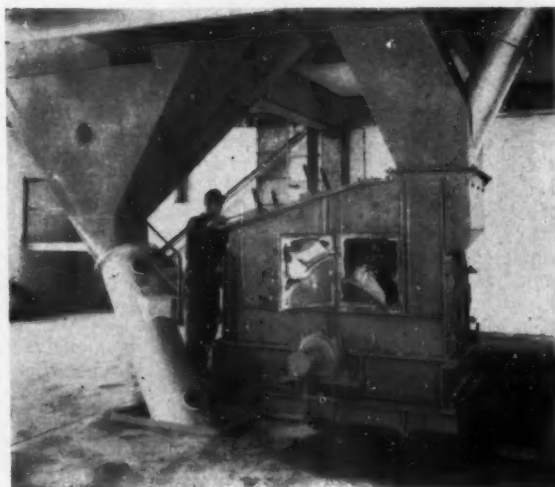
WET FINE GRINDING section of the Neuhof-Ellers flotation mill with a rod mill in closed circuit with spiral classifier. Grinding results of this unit are shown in Hartsaltz Wet Fine Grinding Curves With Rod Mills and Classifiers.

size material recirculated to impact disc mills for further reduction is at the moment the most profitable solution. Attesting to the efficiency of this technique is the fact that, without any major additions to plant installations or major alterations to the impactor, a grinding plant originally rated at 2,000 tons per day could be nearly doubled in capacity in line with the increased rate of mining and without adversely affecting the product.

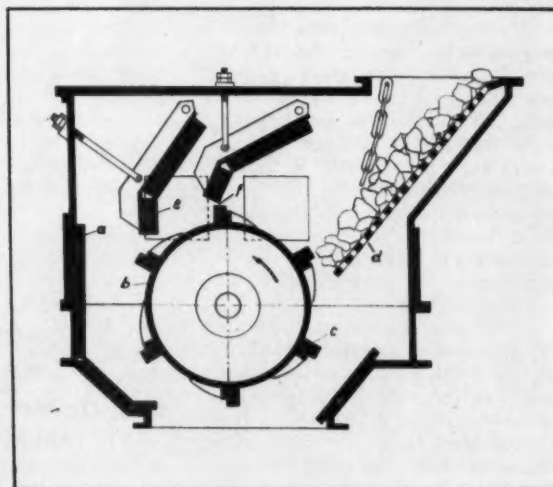
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THE END



IMPACT CRUSHER in operation at the Neuhof-Ellers plant. This is a SAP 4 unit used as a secondary dry crushing unit.



CONSTRUCTION DETAILS and operational features of a top-feed Andreas-designed Hazemag impact crusher.



LONGWALL FACE at Radon uranium mine showing how two rows of Becorit "D" extensible steel props are used to hold back. Mining advances to right with back caving as left hand row of

props is pulled. Blasted ore is slushed along and parallel to face to series of strike drifts where it is loaded into cars and trammed to ore pass.

How Hecla Longwalls U_3O_8 Stopes

Selection of a mining system to mine an ore body with minimum ore loss and maximum profit is one of the most important jobs of the mining engineer. Most times the solution is the best compromise arrived at after evaluating incomplete data, for it is only by actual mining that the true size, attitude, shape, grade, physical properties of the ore and enclosing rock, and other factors are known.

At the Radon uranium mine in Utah's Big Indian district, Hecla Mining Company's engineers had the opportunity to design a complete mining plant, locate the shaft for minimum underground haulage, and develop and prepare the ore body, and select a mining method.

All this planning was made possible by analysis of results from drill holes, ranging from 550 to 700 feet deep, and from the study of underground conditions in other district mines. Here is what they knew: the north-south striking ore body was 2,150 feet long, from 400 to 700 feet wide, one to nine feet thick (averaging five), dipped westerly at 7°, and was a mineralized

arkosic sandstone at the base of the Chinle D formation.

For uranium, it was quite high grade—0.72 percent U_3O_8 . The ore body was continuous with few waste areas where pillars could be left for support. The ore was harder than the mudstone or sandy clay roof and floor. Very little underground water was present.

Once the shaft had been sunk, development was planned in waste for the shaft station, slusher loading pocket, and foot-wall haulage. This plan meant handling a minimum amount of waste. Development workings in ore could be used for either trackless or tracked mining and haulage. Drifting would be pushed to the northern and southern ore limits for retreat mining toward the centralized shaft.

Study Leads to Longwalling

With relatively hard ore, soft and incompetent walls, a few low-grade zones to be left for pillars, and high grade of the ore (about \$65.00 per ton), room and pillar mining was

ruled impractical. Complete extraction with minimum dilution was of paramount importance. The proposal was then made for longwall stoping with caving, retreating from the north and south ends of the ore body toward the shaft.

A search of literature on mining methods revealed the success in Europe and in the eastern United States of longwall coal mining with caving. Both in England and Germany, longwalling is widely used. The Germans, in particular, have been successful in controlling the back with extensible steel props, while a longwall slice was mined. The props are then collapsed recovered, and reused. The roof caves after prop removal to relieve pressure on the longwall face and supports. Actually, maximum pressure of overlying sediments on any longwall face occurs on the unmined solid ore several 10's of feet from the face. Another point of maximum pressure is found well back in the cave three to four times as far from the face as the zone of ore pressure. Between these two points of maximum pressures is a "relaxed core

of the arch" with minimum pressure on the roof along the longwall face. Pressure points and the relaxed core follow the direction of retreat. It is of major importance to keep the mining face straight and not leave any pillars.

Buy German Steel Props

Longwalling requires roof support adjacent to the working face to prevent caving right up to the face. Hecla engineers decided to adopt the proven coal mine practice of using yieldable steel props for temporary support. Becorit "D" props made in Germany were selected and 1,400 were imported at a delivered cost of \$70.00 each. They are made by Becorit Grubenausbau G. m. b. H., at Recklinghausen.

Two sizes were purchased with collapsed heights of 40.5 and 44 inches and extended heights of 71 and 79 inches. To mine thick ore, Hecla has welded 12-, 24-, and 36-inch lengths of 4-inch double-strength steel pipe to the base of some props to lengthen them. Each standard prop weighs 153 pounds. Prop loss has been kept to a minimum by assigning one man to continually count and always know the location of every prop. In 1958 only four props were lost.

Each prop consists of a hollow square outer member to which is welded a base plate, a hollow square inner member to which is welded a



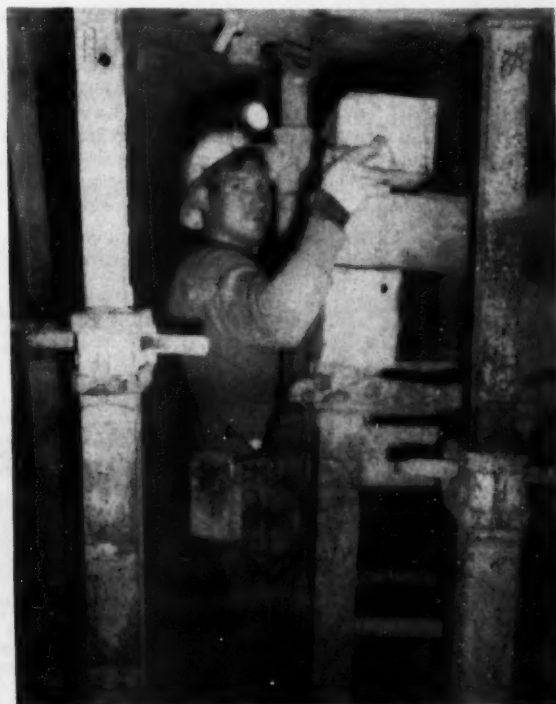
STEEL TRAPS are used to fasten fir lagging to the steel props. Strapping has proven to be fast and easy. To remove lagging cut straps.

steel cap, and a locking device welded to the outer member. The inner member fits inside the outer member and its position is adjusted by the locking device. Each prop will carry a 40- to 50-ton load after only $\frac{1}{8}$ -inch yield. This is important because full loading with minimum yield prevents back slump and breaking of the roof beds.

The locking device is so constructed that as it rolls down through a 13° angle ($\frac{1}{8}$ -inch inner member drop) an ever tighter grip is secured on the inner member. Once this drop takes place, the prop has a continuous yield resistance of about 45 tons. The locking device holds a soft iron block against hard metal beads welded in



STEEL PROPS are tightened in place by this Porto-Power hydraulic ram. Bottom of ram is set on prop's steel lock band and top under "U" plate slipped over inner prop.



OAK BLOCK CRIB is built on top of steel crib base. Note how cribs are placed between prop lines to give extra support. Cribs are wedged tight against the roof.

Radon Stopping Cycle

ESTABLISHED PROP LINE parallel to and four feet away from face starting at one end of stope. Props are recovered from breaker line and moved to the new face line. They are set and jacked in place. Cribs between initial prop rows are pulled, moved between new rows, and reset. In a good stope, the roof caves after a few props have been pulled and it continues to cave following each prop removal. It caves right up to the new breaker line, occasionally across it knocking out a prop, but never to the face. The full length of face is reproped.

DRILL ORE FACE with airlegs. Stopping cycle is based on four-foot units so four-foot holes are drilled at right angles to face and parallel to roof. Wet drilling makes the footwall muddy and slippery so dry drilling with dust collecting equipment has been tried with favorable results. Short-feed airlegs are used for drilling.

LAGGING is next strapped to and on the inside of the face line of props to prevent blasted ore from going into the cave. Actually all holes are slab holes so there is little tendency to throw toward the cave. Douglas fir, 4- by 8-inch lagging is used. It is easily, quickly, and tightly strapped to the steel props with a strapping tool. Lagging is placed to within a few inches of the roof.

LOADING AND BLASTING is carefully done to prevent breaking into the roof and to minimize throwing of ore against lagging. As explained above, the short, flat, holes are shot as a slab round, 30 to 50 holes at one time, using igniter cord and No. 6 caps. As muck is wanted close to the face, the lifter holes are shot right after breaker hole with the rib and top holes last.

SLUSHING moves broken ore along the wall down dip to one of the haulage drifts. Joy, 20-horse-

power remote control double-drum electric hoists pull the 54-inch buckets. Hoists are set along the up-dip side of the drift track, up to 100 feet from the longwall face. The tail block is hung from a cable loop pinned to the back. Corner blocks for cable are supported by rock bolts. Ore is thus slushed from the face down to the end of the drift. The next step is to load it into mine cars.

MUCKING ore into cars is done by an Eimco loader operating on the drift track. The loader moves only a few feet as the broken ore has been well piled by the slusher.

TRAMMING of 40-cubic-foot Granby cars from mucker to ore pass raise is with a three-ton battery locomotive. Now that the broken ore is out of the way, the next step follows.

LAGGING is cut loose from props with an axe and wherever possible piled out of the way in the long-wall face. If there is no room, it is dragged to the nearest drift with a slusher.

HAND CLEANUP of all fly ore missed by the slusher bucket is then necessary to prevent loss.

PULLING PROPS AND CRIBS is the final step in the stopping cycle. A new line of face props is started before pulling the breaker line of props. Two men work together to move props and cribs into a new position. The steel wedge is driven out of the prop to loosen it. In areas where roof is safe, it is then moved eight feet toward the face and reset. At other times when roof is dangerous, the prop is pulled free with slusher. Cribs are pulled, moved, and reset in the proper place after new line has started.

When the roof is under complete control and the mining cycle is working on schedule it is a beautiful thing to watch the roof cave right behind the removal of the breaker line of props. It caves up to the new breaker line (old face line) and follows several feet to a few 10's of feet behind the prop removal.

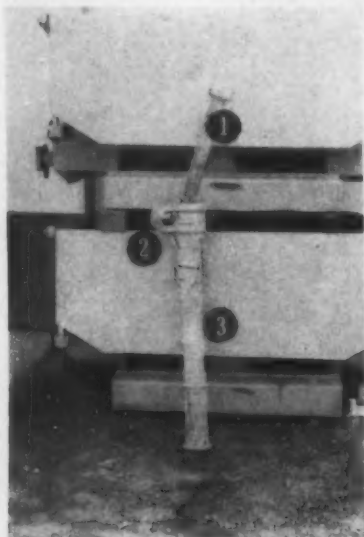
herringbone design on one face of the inner prop. The opposite side of the inner prop slides on a silicon-aluminum friction block in the lock. Under full load the inner prop member slides along the soft-iron block, planing some metal from the block. To set the lock,

a steel wedge is driven into the locking device. To release the lock, the wedge can be easily loosened.

To see a cross sectional drawing of a Becorit prop showing details of construction and the rolling locking action please see pages 34 to 38 of the Aug-

ust 1958 issue of *Mining Congress Journal*, "Longwall Stopping at the Radon Mine", by W. H. Love and P. M. Lindstrom.

Each prop is used with a wood friction block or small headboard. Two miners work together in setting and



CRIB BASES AND CRIB RELEASES are shown above. No. 4 is a side view of crib release with upper section off. The complete release is shown at No. 5. Note the locking T shown at No. 6. This is raised to engage shoulders of top release. T at No. 7 is driven down to release upper section which falls alongside steel crib base.

BECORIT "D" PROP (left) which has been taken to surface for straightening. No. 1 is the inner section which fits into the hollow outer section (No. 3). No. 2 is the locking device showing wedge which is driven into steel strap to tighten inner leg against back-up plate which is an integral part of outer section.

Drilling



Slushing



Mucking



Pulling Chutes



pulling props. It has been found that two rows of props set four feet apart, with the advancing row three to four feet from the face, give good results. This necessitates blasting of 4-foot rounds, or slices. Then the outer row (breaker line) of props is pulled, moved over eight feet (past what was the inner row), and reset as a new inner row. Great care is necessary to set props in a straight line, 3½ feet apart. This makes caving uniform and permits fast lagging and slushing. The base of each prop is set in a small hitch chopped in the floor. While one miner holds the wooden friction block in place, the other extends the prop's inner member and the wedge is driven tight enough to hold the prop in place.

To be effective, any prop must be tightened in place. For stulls, headboards are wedged down. For these extendable steel props, the inner member must be advanced in relation to the lower member. This is done with a 10-ton Porto-Power hydraulic ram actuated by a small hand pump. When the prop has been forced tight, the steel wedge is tightened to firmly set the lock. The bottom of the ram is either set on the steel lock bands or on a welded step plate on the outer

leg. The top of the retracted ram is set against the under side of a two-inch-thick steel "U" plate that slips closely over the inner prop. After the wedge is tightened, the ram is collapsed, the "U" plate removed, and this equipment shifted to the next prop.

To pull the props, the wedge is driven loose to collapse the prop. In most stopes it is then safe for miners to carry the prop over to the next line. In some instances, the slusher cable must be attached to the prop to pull it loose from the cave.

In order to get the initial longwall started, it is usually necessary to drill and blast the roof down outside the breaker line of props. At first three rows of props were tried. However, two rows proved most successful and now is standard practice at the Radon.

Cribs for Extra Support

When caving first started, occasionally the back caved across the prop lines to the face. It became apparent that the better support of the roof was desirable. Therefore, 162 steel crib bases with 648 crib releases were purchased. They are 21 inches square, 30 to 60 inches high, weigh about 250

pounds, and are made from 4-inch H-beams braced and welded to a ½-inch steel base plate. Four crib releases, one at each corner, are bolted to channels welded to the top of the H-beams. A crib release consists of two steel wedges set at a 34° angle to each other so that the top wedge will slide out and off the lower wedge when an inner locking tee is driven upward.

These crib bases are placed between the two lines of props and an oak block crib built on top of them reaching to the roof. Blocks are then wedged tight, the same as a stull would be. To pull and move the cribs, the releases are tripped to reduce height and collapse the blocking.

Longwalling Proves Successful

To summarize: longwall retreat caving was necessary for complete ore extraction with minimum dilution. Use of this mining system was possible because the relatively thin-bedded ore body had a flat dip; there were few waste or low grade zones to interfere with continuous retreat; and the mudstone roof, or hanging wall, caved readily under complete control.

THE END.

... Advice from
National Western Minerals Conference

Find Your Own U_3O_8 Market, Prospect Old Districts, Make Pb-Zn Quotas Work

The nation's leading atomic scientists—from prospector to nuclear reactor designer—gathering in Denver, Colorado in February for the 62nd annual convention of the Colorado Mining Association, heard a detailed report on uranium. The almost unanimous conclusions were that uranium must seek and develop a commercial market, that there was no question of the future of nuclear power, but they couldn't answer the question as to when and how much uranium the power program would require.

An eager crowd of mineral industry leaders attended, too. They came to find out if there would be a market for vanadium after March 1962; what will the revised AEC program do to uranium exploration; what were the minerals to prospect for today; will domestic uranium reserves be exhausted by 1966; what the future of the lead-zinc quotas is; and to seek answers to many other problems and questions.

It was most appropriate that uranium was of greatest interest because it was the 10th anniversary of important uranium discussions at any mining convention, the Colorado Association having first pioneered uranium on its program during its 1949 meeting.

Jesse C. Johnson, director, Division of Raw Materials, of the United States Atomic Energy Commission, predicted the greatest year in history for mining and milling of domestic uranium would be in 1959. He further predicted that the 1959 rate will be approximately stable through 1966. The picture for exploration isn't so favorable because the Commission had withdrawn its market for ore reserves developed after November 24, 1958 on that date.

Mr. Johnson then said, "From now on, exploration, to a large extent, must be based on the anticipated markets—the market that will develop with the growth of industrial atomic power." Such a growth is assured, he said, but he would make no prediction as to when. Thus, there is no great

incentive to prospect for uranium in the immediate future.

This leads to the all-important question: What and where to prospect now and in the future? The partial answer to this problem was supplied by Dr. Thomas B. Nolan, director, United States Geological Survey.

He believes that many unknown deposits which will make new mining districts will be found in the west underneath recent volcanic rocks and alluvium. Fortunately it now appears that some new geochemical techniques may give a clue to such deposits. The Survey plans to look for such. The continuing search for high-grade deposits will also disclose, "more and more deposits that by present standards are too low in grade, too refractory, or too costly to work," he added.

"These below-grade deposits are of two types. One is uniformly low in grade and has never progressed in its exploitation beyond the prospecting stage. Deposits of this type are, in some instances, of extremely large tonnage, and may contain more than one substance of value. Once the inevitable advances in mining and beneficiation are made, they will be worked.

"The second kind of marginal deposit is represented by the material left behind as unprofitable during the mining of higher grade ores; the rock on the other side of the 'assay walls'. Such material, I believe, is a potential major resource that awaits only the technological advances to be productive." Butte, Montana is the classic example of this concept where a large volume of mineralized country rock in which stopes have been mined for 75 years is today being mined by open pit and block caving, Dr. Nolan pointed out.

Another way to find new ore in old places, actually "Industrial Minerals in Old Mining Camps," was outlined by W. C. Peters, geologist, Westvaco Mineral Products Development. His study was based on the geological association of industrial minerals with



AEC SPOKESMEN Jesse Johnson and Allen Jones of Raw Materials Division.



UNDERGROUND MINERS: John Hill in uranium, Bill Anderson, Hecla Mining Co.



ATOMIC FUELS: Westinghouse's L. A. Meierkord and Carl Dismant, U_3O_8 miner.



MINE SUPPORT by Homestake's C. N. Kravig and Empire Zinc's W. Jude.



LEAD-ZINC spokesmen presented report on effectiveness of Import Quotas. Zinc Institute's J. L. Kimberley is speaker.

Miners Meet in Denver



URANIUM PANEL drew top spokesmen from all parts of the nation. Leaders in every phase—prospecting to reactor designers—answered hundreds of questions.



AMBROSIA LAKE miners Ray Schultz and Tom Evans, speakers on uranium.



RUSH TO THE ROCKIES BANQUET was convention highlight to celebrate the 100th anniversary of Colorado mining.



In recognition of the outstanding achievements and technical developments made by mining companies and engineers, MINING WORLD makes five annual awards. These awards express the industry's appreciation for the work that is done for the advancement of all mineral sciences, and for the enlightened management and operation of today's mining enterprises.



SMALL MINING COMPANY OF 1958 plaque is accepted by John Featherstone, vice president and general manager of Lucky Friday Silver-Lead Mines Company.



UNDERGROUND MINE OF YEAR award is to Homestake-Partners' Section 32 mine at Ambrosia Lake, New Mexico, Superintendent Dick Stoehr accepts the mine plaque.



TECHNICAL ACHIEVEMENT OF 1958 was commercial flotation of western phosphate by San Francisco Chemical Co. D. L. King, pres., receives award.



OPEN PIT MINE OF 1958 honor was won by Lucky Mc Uranium Corporation. Company president Allen Christensen accepts testimonial plaque for staff.



MAN OF AMERICA IN 1958 was Howard I. Young, American Zinc, Lead and Smelting Company president. MINING WORLD Editor George O. Argall, Jr. presents Mr. Young with engraved silver plate in recognition of his leadership and services to the mining industry, services which have no parallel in our times.

volcanic, intrusive-plutonic, metamorphic, and hydrothermal metal deposits.

Thus, these two leading geologists told where, how, and what minerals to look for. The answers on how to mine these deposits in light of the changes and advancements in the science of mining were given by L. J. Parkinson, professor of mining engineering, Colorado School of Mines, Golden, Colorado.

While advances and changes in mining techniques in the last third of a century have been more rapid than during any previous period of even double its length, the future trends and developments are unlimited, Professor Parkinson said. He and a Swedish friend outlined probable future trends to be: Use of smaller diameter drill holes to get good fragmentation underground as well as in open stopes; rotary drilling in medium hard rock; further refinements in millisecond blasting; better loading apparatus for explosives; better raising methods; use of larger cars underground; further developments in automatic hoisting; rotary percussion drills; and fluid transport of material underground.

The Emergency Lead-Zinc Committee's short range policy continues to be that of "trying to make quotas work," reported Charles E. Schwab, committee chairman. Meantime a seriously growing problem of imports of manufactured lead and zinc must be solved. The President's Quota Proclamation imposes no control at all over manufactured items so the foreigners have resorted to simple

manufacturing processes to circumvent the quota, he reported. "It appears that we might have to travel the Escape Clause route" to solve this problem, Mr. Schwab added. The foreigners have done well under the quotas, too, despite the early cries, he said, because "simple arithmetic will plainly show that foreign exporters are going to be better off under quotas in a more stable, fairly priced United States market than they were with unrestricted, large volume imports at distressed prices in the pre-quota period."

Watch Wyoming Uranium

Wyoming's growing importance as a uranium state was documented by Roy Peck, vice president, Shoni Uranium Corporation of Riverton. He reported that Homestake Mining Company had developed 500,000 tons of ore at its underground Hauber mine in the Black Hills; that many millions of tons of high grade ore, a great deal of it 1.00 percent U_3O_8 , had been developed in the Shirley Basin. First production would come from a new underground mine of Utah Development Company under a \$1,000,000 mining program. Lisbon Uranium Company will sink a round concrete shaft to mine its central Gas Hill ore bodies. In Crooks Gap, Green Mountain Uranium Corporation (Phelps Dodge Corporation) and Lucky Mc Uranium Corporation will develop underground mines. Continental Materials Corporation successfully pioneered underground mining in central Wyoming.

A fine list of technical papers were read by leading engineers. On the first morning of the convention, Snell Burk, mine and mill design engineer, Climax Molybdenum Company Division, American-Metal Climax, Inc., described the new byproduct plant at Climax, Colorado which uses gravity and flotation concentration to recover 0.03 percent WO_3 , 1.25 percent FeS_2 , and a trace of tin in the 32,000 daily tons of molybdenum tailing. Mr. Burk emphasized the importance of pilot plant testing to properly evaluate the possibility of recovery of very small amounts of minerals in any ore.

A second production shaft for the operating uranium mines at Ambrosia Lake, New Mexico is not justified by a district study made and results reported by Ray Schultz, superintendent, Rio de Oro Uranium Mines, Inc. His study showed that for the long narrow ore bodies of the district the maximum underground haulage of one mile was certainly well inside the economic distance for either rail or truck haulage.

A new chemical grout, American Cyanamid Company's AM-9, has been developed and proven to be very effective in shutting off underground water infiltration, reported R. H. Karol, field research engineer. AM-9 can be pumped anywhere that water will flow and then will gelatinize almost instantaneously to form an impervious barrier. The time of gelation can be varied and controlled accurately for optimum results.

THE END

Shattuck Denn Releases Costs at Convention



It cost \$125.79 per foot to sink the 840-foot-deep Bardon shaft of the Shattuck Denn Company, reported Carl W. Appelin, company engineer. Formal sinking of 730 feet of shaft with 114 rounds was accomplished in 64 days. However, cost figures are calculated for full period from June 15 to November 17, 1958. A complete description of shaft sinking methods at this Big Indian, Utah uranium mine was given in the December 1958 issue of MINING WORLD, pages 37 to 39. Here's how the costs broke down for this shaft:

SUPPLIES AND EQUIPMENT		COST PER FOOT FOR 840 FEET
Explosives	\$ 7,674.00	\$ 9.14
Timber	13,544.75	16.12
Drill steel	2,785.40	3.32
Air drill repair parts	2,390.71	2.85
Electric power	2,101.79	2.50
Equipment rental	457.65	0.54
	\$28,954.35	\$34.47
WAGES AND SALARIES		
Drilling	\$14,857.96	\$17.69
Mucking	10,123.52	12.05
Timbering	23,549.65	28.04
Muck removal ¹	4,152.93	4.94
General shaft	1,733.51	2.09
Framing timber	4,970.65	5.92
Equipment repair	2,979.27	3.55
Trucking supplies	196.34	0.23
Plant water	788.89	0.94
General surface	1,497.94	1.78
Supervision	11,836.72	14.09
	\$76,707.68	\$91.32
Totals	\$105,662.03	\$125.79
1. 27.4 percent of total. 2. 72.6 percent of total. 3. From shaft collar to dump.		

Automation

Controlling Slurried Reagent Feed Rate

By CARL MARQUARDT

In many large flotation mills, feeding slurried reagents has created a control problem. Also, the feeding of small amounts of reagents accurately has required expensive equipment which has often impeded the application of modern process control devices.

At some flotation mills, it has been difficult to obtain a milk of lime that is free from sand and other abrasives. When attempts have been made to employ control valves of conventional design it has been found that the valves will erode and cut out within a very few days. Attempts have been made to use rubber-lined Saunders Patent valves for these applications but they, too, have very quickly cut out because as the valve is throttled toward the closed position, the valve tends to close along a line. In so closing, high velocities are created through the valve, resulting in valve erosion. Also, closing along a line,

there is a tendency for the valve to plug.

A time-modulated reagent feeding control system has provided an inexpensive and extremely reliable means of solving these problems.

How To Feed Slurries

With the time-modulated reagent control system for slurry feeding, the Delta valve, developed by the Galigher Company of Salt Lake City, is employed. This rubber-lined valve can be closed either by air or a hydraulic fluid. Air is admitted to both halves of the valve between the valve body and the rubber lining. The valve is closed by admitting the air (or hydraulic fluid) at sufficient pressure to collapse the rubber lining against the pressure of the system. The valve is opened by releasing the pressure.

The valve is then operated either completely open or completely closed. Flow control is achieved by the time that the valve is open or closed. The valve is operated on a 10-second repeat cycle with the percentage of time that the valve is open variable from 1 to 100 percent of the 10-second cycle. If 50 percent lime feed is wanted, the valve is open 50 percent

of the time, and closed 50 percent of the time. If 25 percent of the total lime feed is wanted, then the valve is open 25 percent, closed 75 percent of the time, etc.

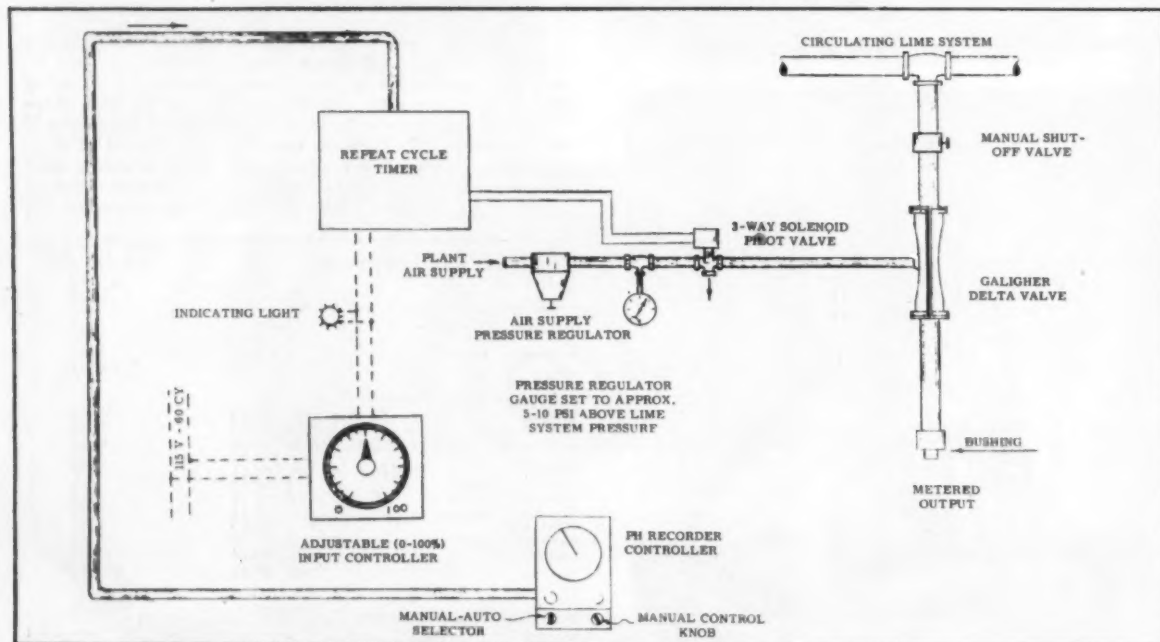
Generally speaking, a bushing or limiting orifice is used to limit the maximum flow of material through the valve when it is open 100 percent of the time. Thus, it is possible to control the valve from a minimum to a maximum flow of material.

The advantage of the system is that there is no throttling of the valve; therefore, valve erosion is not a problem. The valve is not closed for a sufficiently long period of time to allow the slurry to settle and pack. There is no problem with line plugging. The time cycle, being 10 seconds, is sufficiently rapid so that for all practical purposes the flow of material may be considered continuous. The flotation process is not adversely affected.

For manual operation a manually set electrical interrupter is used while for automatic operation a precision pneumatic interrupter is employed. The pneumatic interrupter operates from a standard process control signal of from 3 to 15 pounds per square inch. At 3 pounds per square inch the

Mr. Marquardt, president of Industrial Physics and Electronics Company, Salt Lake City, Utah, has pioneered instrumentation and control of milling circuits.

SLURRY FEEDING installation and wiring diagram.

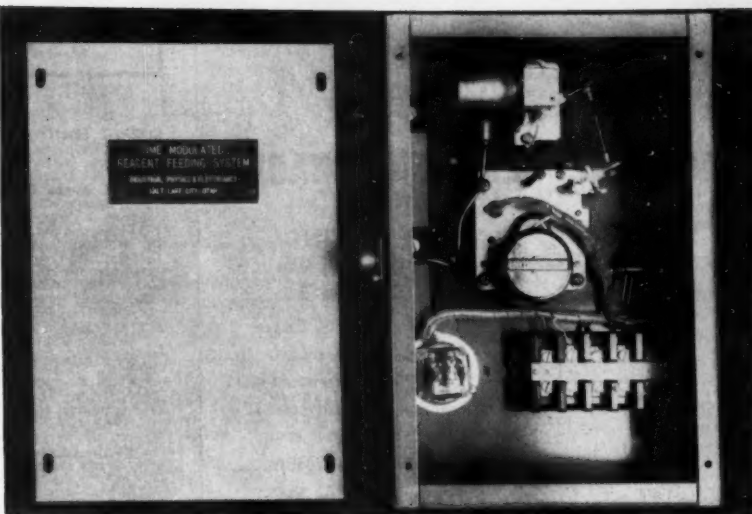


valve is opened 100 percent of the time and at 15 pounds per square inch of pressure on the pneumatic interrupter, the valve is closed 100 percent of time. At points in between these two extreme pressures, the valve is opened or closed a proportionate amount of the time to an accuracy of 0.5 percent. Thus the system is ideally adapted to automatic process control.

The general arrangement of the valve for automatic control is shown in diagram. A three-way valve is operated to apply a pneumatic signal to the Delta valve, the pneumatic signal being great enough to close the valve against the line pressure of the reagent system. The Delta valve will close with an applied pneumatic (or hydraulic pressure) that is greater than the line pressure by only 5 pounds per square inch. Being constructed from live rubber and fabric, the Delta valve will withstand many opening and closing actions.

How To Feed Small Quantities

Where it is desired to control the feeding of minor amounts of reagents, such as pine oil, xanthate, and others, the Delta valve is not practical. For these applications, a simple solenoid magnetic valve can be used. Downstream from the magnetic valve an orifice is inserted in the line, the orifice being made of sufficient size to deliver the maximum required flow when the solenoid valve is open 100 percent of the time. The general arrangement for this type of control sys-



SMALL COMPACT electrical control used for time modulated reagent feeding. This unit regulates by closing and opening valve from 1 to 100 percent of 10-second cycle.

tem is diagrammed.

Since solenoid valves are made in all types of corrosion resistant materials, it is obvious that the time-modulated system of reagent feeding lends itself to practically any type of reagent feeding problem.

Where all-electrical systems are employed, interrupters are available for servo mechanism positioning with the same accuracy as is available for pneumatic positioning.

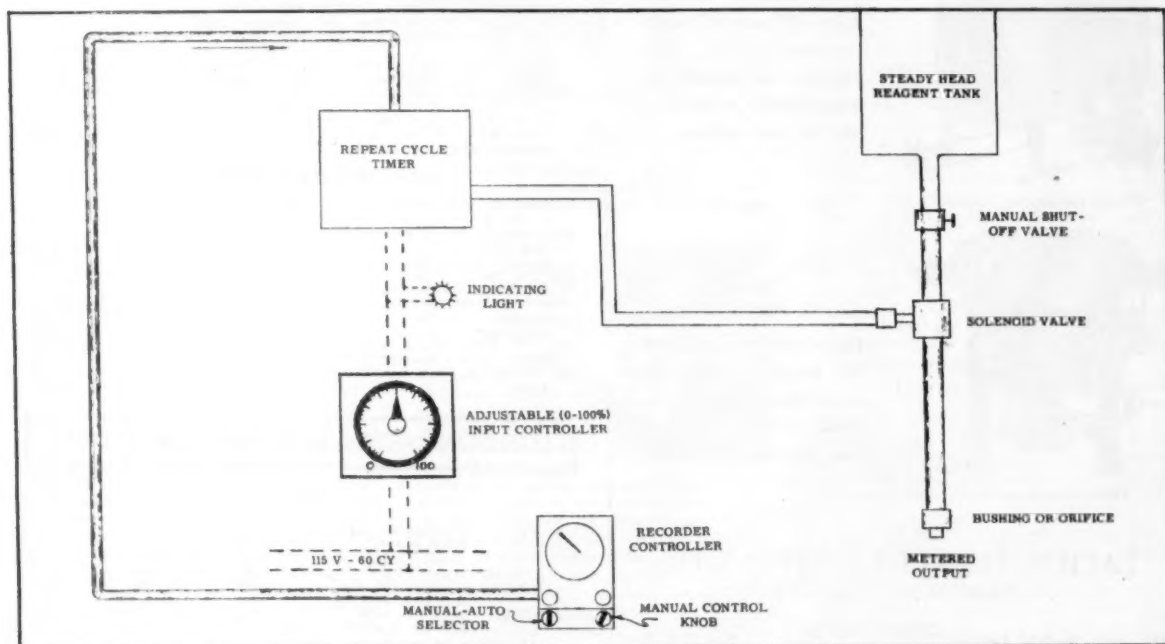
The time-modulated system of control thus is adaptable for practically

every conceivable means of reagent control. The only requirement is that the system pressure should remain relatively constant so that the flow will be proportional to the period of time that the valve is open. Under normal operating conditions, this requirement is not difficult to obtain.

The time-modulated reagent system of control offers an extremely broad range of applicability and should allow for the solution to many difficult reagent feeding problems.

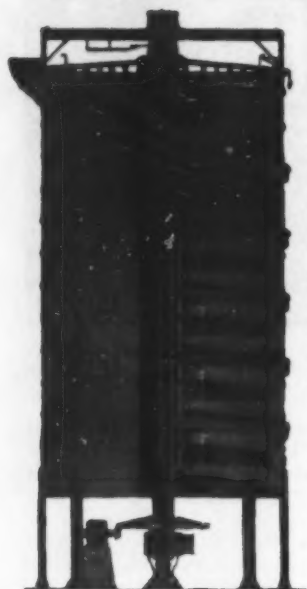
THE END

REAGENT FEEDING installation and wiring diagram.





MULTIPLE HEARTH FURNACE

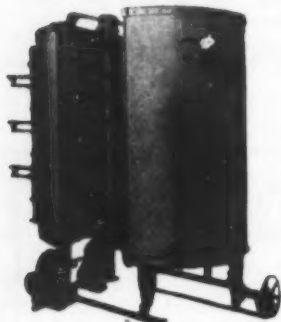


SIZES 8' 6" TO 22' 3" DIAMETER
NUMBER OF HEARTHS, 1-16

ROASTING CALCINING DRYING

ZINC ORES	QUICKSILVER
IRON ORES	MAGNESITE
COPPER ORES	LIMESTONE
TIN ORES	MOLYBDENUM
NICKEL ORES	BONE CHAR
LEAD ORES	DIATOMITE
SODA ASHES	LIME SLUDGE
FULLERS EARTH	MAGNESIUM
CARBON	CLAY GRANULES
PYRITE	ANTIMONY

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SEWAGE SLUDGE
LEAD CHEMICALS
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METALS

FEBRUARY 20, 1959

COPPER: Electrolytic, Delivered F.o.b. cars, Valley basis (pound)	30.00¢
Lake, Delivered, destinations, USA	30.00¢
Foreign, Delivered, destinations, USA	30.00¢
Custom	29.50¢
LEAD: Common Grade, New York (Per pound)	11.50¢
ZINC: Prime Western: F.o.b. E. St. Louis (Per pound)	11.50¢
Prime Western: Delivered, New York	12.00¢
Tri-State Concentrate, 60% zinc, per ton	\$68.00
ALUMINUM: Primary 30 Pound Ingots (99% plus) (Per pound)	26.80¢
ANTIMONY: Long Star Brand, F.o.b. Laredo, in bulk (Per pound)	29.50¢
BISMUTH: (In ton lots) price per pound	\$2.25
CADMIUM: Sticks and bars, 1 to 5 ton lots (Price per pound)	\$1.45
COBALT: 97.99%, keg of 550 pounds (Price per pound)	\$1.75
COLUMBIUM: Powder	Nom., per pound \$55.00-\$85.00
GERMANIUM: Germanium: dioxide, high purity, gram	18.50¢
LITHIUM: 98% (per pound)	\$11.00-\$14.00
MAGNESIUM: Ingots (98.8%) F.o.b. Valasco, Texas, per pound	36.00¢
Mercury: Flasks, small lots, New York	\$218.00-\$222.00
NICKEL: "F" Ingots (5 pounds), F.o.b. Port Colborne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5%, per pound	\$7.00
THORIUM: per kilogram	\$7.00
TIN: Grade A brands, 100 lb. casks, Prompt delivery	\$1,026
TITANIUM: 99.3% + Grade "A" Sponge (Per pound)	\$1.70-\$1.82
URANIUM: Rod (0.790 U-235) \$16.00 Per pound; Foil	\$16.75
U-235: Nominal (Per pound)	\$7,725
GOLD: United States Treasury Price	\$35.00 per ounce
SILVER: Newly mined domestic, U.S. Treasury price per ounce	90.5¢
Foreign Handy Harmon	\$90.00
PLATINUM: Per ounce	\$57.00-\$60.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: 10 to 12% BeO, F.o.b. mine, Colorado \$46.00 per unit	
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$48.00.	
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons	
African (Rhodesian), 48% Cr ₂ O ₃ , 3 to 1 Ratio	\$44.00-\$45.00
African (Transvaal), 48% Cr ₂ O ₃ , No ratio	\$31.00-\$33.00
Turkish, 48% Cr ₂ O ₃ , 3 to 1 chrome-iron ratio	Nominal \$50.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal	\$1.00
IRON ORE: Lake Superior, Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe	\$11.45
Mesabi, Bessemer, 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	26.00¢
MANGANESE ORE: Metallurgical grade, 48 to 50% Mn. Long ton unit	\$1.00-\$1.05
Metallurgical grade, 46 to 48% Mn. Long ton unit	\$0.95-\$1.00
Metallurgical grade, 44 to 46% Mn. Long ton unit	\$0.85-\$0.90
Domestic U.S. Government purchasing depots: Butte, Mont.; (black and pink ores) base price of \$4.87 per long dry ton of 18% manganese ore. Phillipsburg, Mont.; base \$6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% base (48%) \$2.30 per unit with premiums and penalties.	
MOLYBDENITE CONCENTRATE: 90% MoS ₂ F.o.b. Climax, Colorado. Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic, 60% WO ₂ Per short ton unit	Nominal \$21.00
Foreign, 65% WO ₂ Per short ton unit (Schaeffite)	Nominal \$14.00
Foreign: South American, Spanish, Portuguese	Nominal \$13.00
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U ₂ O ₅ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum 4.25 specific gravity, per short ton	\$16.00
BENTONITE: Minus-200-mesh, F.o.b. Wyoming. Per ton, car-load lots	\$12.50
Oil Well grade. Packed in 100 pound paper bags	\$14.00
BORON: Technical grade	\$47.50
FLUORSPAR: Metallurgical grade, 72.5 % effective CaF ₂ content per short ton F.o.b. Illinois-Kentucky mines	\$36.00-\$40.00
Mexican, 70% F.o.b. border	\$26.00-\$27.00
Acid Grade, 97% CaF ₂ , Bulk, F.o.b. mine	\$48.00-\$52.00
PERLITE: Crude: F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades. Crushed and sized, F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$25.00
Export	\$24.00-\$25.00

LONDON METAL AND MINERAL PRICES

February 20, 1959

Per Long Ton USA Equivalent cents per pound

COPPER: Electrolytic spot	£237	0s Od	29.63¢
LEAD: Refined 99%	£ 70	0s Od	8.75¢
ZINC: Virgin, 99%	£ 74	0s Od	9.25¢
ALUMINUM: Ingot, 99.5%	£180	0s Od	22.50¢
ANTIMONY: Regulus, 99.6%	£197	10s Od	22.69¢
TIN: Standard, 99.75%	£770	10s Od	96.31¢
TUNGSTEN: Long ton unit	88s		12.32¢
1. With Sterlink			Pound at \$2.80

Quotations on metals and certain ores through the courtesy of American Metal Market, New York, N. Y.

MINING WORLD

United States

Personalities in the News

EDWIN A. SLOVER has been appointed general manager of the China Mines Division of Kennecott Copper Corporation at Hurley, New Mexico. Mr. Slover joined China Mines Division in 1939 to start a new smelter and became the division's first smelter superintendent.



As newly named general manager, he succeeds W. H. GOODRICH, who has retired. In addition to his duties at China during the past year, Mr. Slover has served as consulting specialist in the building of Kennecott's new smelter at the Ray Mines Division in Arizona.

Hyman Kelley is the new manager of the Burro Mountain Branch, Phelps Dodge Corporation, at Tyrone, New Mexico. He replaces John Stock who has been transferred to Phelps Dodge operations at Morenci, Arizona.

A. C. Seaberg has been appointed superintendent of the Lind-Greenway mine for Jones & Laughlin Steel Corporation, Minnesota Ore Division. He is succeeded as general mine foreman at the company's Hill Annex Mine by Joseph R. Gross.

Under a recent reorganization at the Kennecott Copper Corporation's Utah mine, operations have been divided among three mining departments—East Side, West Side, and Pit. Each department has its own track, drilling and blasting, and other operations support. Reassignments have placed John Niemi, former general mine foreman, as superintendent, Pit Mining Department; L. E. (Bud) Snow, former general drilling and blasting foreman, as superintendent, East Side Mining Department; and Albert Kastelle, former general mill foreman, as superintendent, West Side Mining Department.

Richard C. Wells, president of National Potash Company, a jointly owned subsidiary of Freeport Sulphur Company, has been elected executive vice president of the Freeport Sulphur Company. The Board also elected William B. Porterfield, Jr., assistant vice president.

The Nevada Mining Association, Inc., which recently held its annual meeting in Reno, Nevada, elected the following directors: Henry S. Curtis, plant manager, American Potash & Chemical Corporation; Roy A. Hardy, executive vice president, Getchell Mine, Inc.; Robert O. Jones, Western Division manager, Standard Slag Company; William L. Kendrick, vice president and general manager, Manganes, Inc.; John C. Kinnear, Jr., general manager, Nevada Mines Division, Kennecott Copper Corporation; John C. MacDonald, resident manager, Nevada & Arizona, U. S. Lime Products Division of The Flintkote Company; A. E. Millar, general manager, Yerington Mine, The Anaconda Company; H. P. Willard, works manager,

Western Division, Basic Incorporated; and S. H. Williston, executive vice president, Cordero Mining Company. The Board elected the following officers to serve for the ensuing term: John MacDonald, president; John Kinnear, Jr., first vice president; Roy Hardy, second vice president; Louis Gordon, executive secretary; and John Kinnear, honorary president.

William B. Hall, president and general manager of Vitro Uranium Company, Salt Lake City, Utah since 1954, has been placed in charge of chemical and metallurgical operations of the parent Vitro Corporation of America. He was also named vice president of the corporation.

James A. Reynolds has been advanced to the position of superintendent of the crushing and concentrating department for Reserve Mining Company's Silver Bay, Minnesota operations. His newly appointed assistant is William P. Pearson. Mr. Reynolds first joined Reserve at its Ashland, Kentucky pilot pelletizing plant and moved to the preliminary taconite plant at Babbitt, Minnesota in 1952. In 1955, he moved to Silver Bay as assistant superintendent of the crushing and concentrating department.

Warren C. Stover of Rivermines will assume the job of safety engineer in charge of the safety department of St. Joseph Lead Company, Bonne Terre, Missouri. Mr. Stover will be succeeded as mine superintendent of Bonne Terre and National Mines by Marvin E. Lane.

Wayne H. Burt, former Arthur Mill superintendent, has been advanced to the position of superintendent of the Kennecott Copper Corporation's Utah refinery. Mr. Burt, a graduate of the University of Utah, has filled assignments at the Utah mine, mills and refinery; at Braden Copper Company, a Kennecott subsidiary in Chile; and the New York office.

Five staff members of the New Mexico Institute of Mining and Technology presented papers at the recent New Mexico Academy of Science meeting at the University of New Mexico.

CLYDE WILLIAMS of Columbus, Ohio, metallurgist and former president of Battelle Memorial Institute, has been awarded the James Douglas Gold Medal of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Formal presentation was made at the annual banquet of the A.I.M.E. during its national meeting in San Francisco, California, last month. The specific citation drawn up by the AIME Board of Directors stated that the Medal went to Clyde Williams "for outstanding contributions in non-ferrous metallurgy particularly through stimulating research and interest in the basic metallurgy and the use of both the common and less common metals."



ROBERT A. BEALL, U.S. Department of the Interior scientist of Albany, Oregon has been named recipient of an Arthur S. Flemming Award given annually to outstanding young men in the Federal government. Mr. Beall, an authority on the melting and casting of rare and reactive metals, heads the melting laboratory of the U.S. Bureau of Mines' Northwest Electrodevelopment Experiment Station at Albany. He directed a Mines research team that melted all the zirconium for the original reactor used in the atomic-powered submarine Nautilus.



The men and their papers were: Dr. Marvin H. Wilkening, "The New Mexico State-wide Physics Examination"; and "Energy from the Atom"; Dr. Joseph A. Schuffe, "Demineralization of Saline Water"; Dr. Edwin C. Coolidge, "Organic Complexing Agents . . . A Survey"; Dr. William D. Crozier, "Meteorites Spherules in Sediment"; and Dr. Burrell Wood, "First Hand Observations of Science Education in Universities in Europe."

Dr. J. R. Van Pelt, president of Michigan Tech at Houghton, Michigan, recently announced the organization of an industrial advisory committee to the college's Institute of Mineral Research. Members of the committee are: R. S. Archibald, president of North Range Mining Company; Robert W. Braund, manager of Michigan ore division of Jones & Laughlin Steel Corporation; William L. Daoust, state geologist with Dept. of Conservation in Michigan; Philip B. Dettmer, staff metallurgist with Hanna Coal and Ore Corporation; Herbert D. Doan, manager of chemical products division of Dow Chemical Company; A. S. Kromer, vice president and general manager of Calumet division of Calumet & Hecla, Inc.; C. J. McKie, superintendent of Quincy Mining Company; William L. McLaughlin, testing & research engineer for Michigan State Highway Dept.; R. D. Satterley, general manager of ore mines of Inland Steel Company; H. R. Schemm, vice president of Huron Portland Cement Co.; C. DeWitt Smith, vice president of Copper Range Company; and Stanley W. Sundeen, manager of research and iron ore development of Cleveland-Cliffs Iron Company.

Two members have been added to the technical staff of the San Francisco office of the California Division of Mines. They are James R. Evans, graduate geologist from University of Southern California, and J. L. Burnett, geologist from the University of California.

Carl E. Mills, manager of the Copper Queen Branch of Phelps Dodge Corporation, Bisbee, Arizona, has retired after 33 years of service with the company and allied firms. Mr. Mills graduated from Michigan College of Mines.



Two typical weld samples using Stody Iron Powder Build-Up. At left is a stringer bead showing high build-up with a single pass. At right is a two pass weaving bead. Etched and polished ends show depth of penetration. Compare these results with your present build-up material.

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Newsmakers in International Mining

MERLYN WOODLE has been appointed manager of the Babbitt Division of Reserve Mining Company. Mr. Woodle has been assistant manager since May 1958, and has been acting as manager for several months. He has had experience in copper mining in Arizona, bauxite mining in Arkansas, and iron mining in Liberia, West Africa where he served as acting manager of the Liberia Mining Company, Ltd.



Elpidio C. Vera recently assumed the position of assistant director of the Philippine Bureau of Mines. Mr. Vera was formerly chief of the Bureau's Geological Survey Division. He succeeded **Leopoldo Abad** who retired after 65 years of government service.

Dr. J. E. Holloway has been appointed part-time economic consultant to the Union Corporation Limited. He served as Union High Commissioner in London, England until recently.

N. G. W. Comyn has been appointed a director of South African Manganeses Limited.

James A. Pike, vice president of the Newmont Mining Corporation of Canada Limited, has been elected president of the Mining Association of British Columbia, Canada. He succeeds **L. T. Postle**, who served as president for 1957 and 1958. Other officers elected by the group are: **E. O. T. Simpson**, first vice president; **G. A. Gordon**, second vice president; **H. E. Doelle**, **B. E. Hurdle**, **M. M. O'Brien**, **J. D. Christian**, **Dr. H. T. James**, **B. O. Brynelsen**, **R. W. Wilson**, and **L. T. Postle**, executive committee members.

E. C. Corlett has been elected a director of Consolidated African Mines Limited.

Fifteen Yugoslav miners recently visited the United States and toured the Western States. Members of the delegation were: **Dimitrije Dimovic**, **Zivojin A. Gligorijevic**, **Jovan S. Kostic**, **Miomir M. Petkovic**, and **Ljubisa D. Tokin**, all of the Copper Mining Corporation, Bor, Yugoslavia; **Mladen Ivan Gajic**, **Milos D. Maksimovic**, **Radomir D. Milojevic**, **Bosko Knezevic**, **Milovan M. Soldatovic**, and **Momcilo M. Terzic**, all of Rudarsko Toponickarski Bazen at Bor; **Miloljub Grbovic**, **Dragutin V. Popovic**, **Svetislav Radivojcevic** of Rudnik Bakra at Majdanpek; and **Vladimir Tihvinski** of Mining & Metallurgical Basin at Bor. Stops in the United States included Ingersoll Rand Corporation, Phillipsburg, New Jersey; Bethlehem Cornwall Corporation, Cornwall, Pennsylvania; U.S. Bureau of Mines in Tucson, Arizona; Phelps Dodge Corporation at Bisbee and Ajo, Arizona; San Manuel Arizona Corporation, San Manuel, Arizona; Inspiration Consolidated Copper Company, Inspiration, Arizona; Kennecott Copper Corporation and Eimco Cor-

poration, Salt Lake City, Utah, National Western Mining Conference, Denver, Colorado; **E. J. Longyear** Company, Minneapolis, Minnesota; **White Pine Copper Company**, **White Pine, Michigan**; **Allis Chalmers**, **West Allis, Wisconsin**; **Joy Manufacturing Company**, **Michigan City, Indiana**; **Department of Labor, American Council on Education**, **Department of Interior**, and **International Cooperation Administration**, in **Washington D. C.** before returning to **Yugoslavia**.

J. W. Higgerty has been re-elected chairman of Base Minerals Association Limited. Also elected to office was **A. R. R. Weedon** as vice president.

The **Tanganyika (Africa)** government has named three of the four directors who will represent them on the Board of the **Williamson Diamond Mine** at **Mwadui** which it now owns equally and runs jointly with **De Beers Consolidated Mines**. The three directors are: **M. A. Carson**, manager of **Ralli Brothers**; **David Makwaia**, former assistant manager of the Ministry of Land and Mineral Resources; and **M. J. Davies**, ministerial secretary of the General Secretary's Office. The four directors representing **De Beers** are **Harry Oppenheimer**, chairman of **De Beers**; **Philip Oppenheimer**; **A. Wilson**; and **I. Chopra**.

A. T. Davidson has been appointed Chief of Mining and Lands Division, Northern Administration and Lands Branch, Canada. Mr. Davidson, formerly Assistant Deputy Minister of Natural Resources for Saskatchewan, will be responsible for the aspect of resource management in the Northwest and Yukon Territories that deals with minerals, gas, oil and timber, and with territorial and Crown lands.

Arthur R. Rattew has joined the staff of the Airborne Geophysical Division of Canadian Aero Service Limited. Mr. Rattew, formerly with the Newmont Mining Corporation as a geophysicist, is a graduate of the University of Toronto.

Members of a preliminary assistance mission of the International Atomic Energy Agency (IAEA) recently returned from a visit to Burma, Thailand, Indonesia and Ceylon where they surveyed conditions and possibilities in the field of nuclear energy. The mission, which was headed by **Dr. Grigorieff** of the IAEA, was composed of four experts made available by member states of the United Nations for this purpose: They were **Dr. Hugh Belcher** (United Kingdom); **Dr. Georges Bigotte** (France); **Meheshwar Dayal** (India); **Professor Eleg Kazatschovsky** (USSR); and **Charles D. Beaumont**, **Dr. Grigorieff**, **Francois Pikler** and **Dr. Harold H. Smith** from the IAEA Secretariat. Among other things, the survey included a study of the availability of raw materials.

A. F. Purificacion, former mill shaft foreman with **Mindanao Mother Lode Mines, Inc.** at **Cabangan Zambales, Philippines**, is now at the **Phillex Mining Corporation** in **Baguio City**.

Harold N. Ross, formerly managing director, **Kongsberg Solvverk, Kongsberg, Norway**, has recently assumed the post of government mine inspector at **Idungarden, Oppgang C, Trondheim, Norway**.

Leo T. Norville, Chicago attorney, has been elected to the board of directors of **Stanrock Uranium Mines, Ltd.** of **New York and Toronto**. **Stanrock Uranium** owns and operates one of **North America's largest uranium mines**, located in the **Algoma district of Ontario**, the world's biggest uranium producing area.

J. J. Denson, formerly at **Torreón, Coahuila, Mexico**, is now with **La Perla, Minas de Fierro, S. A. at Cd. Camargo, Chihuahua, Mexico**.

M. W. Rushton, former assistant consultant engineer with **Anglo American Corporation** in **Salisbury, Northern Rhodesia**, has taken over the general managership of **Nchanga Consolidated Mines**. He replaces **Stanley Giles**, who has resigned to assume the position of diamond consulting engineer for **Anglo American** in **Johannesburg, South Africa**.

G. C. Tampubolon, Indonesian mining engineer, has moved from **Bangka to Djakarta, djalán Tengju Umar 53**.

H. G. McKerrow will retire from the position of chief consulting engineer with **Anglo American Corporation of S.A. Ltd.** at the end of 1959, and will simultaneously resign from the Board of the corporation. He will, however, remain on the boards of **President Steyn, Daggafontein, and Vaal Reefs** companies. Mr. McKerrow received his early training at the **Camborne school of mines**, gained his initial experience in the diamond mining industry, and transferred to the copper mines of **Northern Rhodesia** where he became general manager of **Rhokana Corporation** in 1938. Since 1946, he has been associated with introduction of new mining techniques in the diamond mines of **South Africa**. He was awarded the **O.B.E.** in 1943 for his part in organizing the increased copper output required for the war effort. **A. Royden Harrison** will succeed Mr. McKerrow as chief consulting engineer of the Corporation.

JOHN B. KNAEBEL has been appointed president and managing director of **Anaconda Iron Ore (Ontario) Limited**, a subsidiary of **The Anaconda Company (Canada) Limited**. Mr. Knaebel, a mining engineer and geologist, has been associated with the



Anaconda organization since 1946, and has headed many of its exploration projects in the Western Hemisphere. Mr. Knaebel is well known in mining circles, being the recipient of the "MINING WORLD Man of the Year for 1956" Award, as well as the **AIME's Saunderson's Gold Medal**.

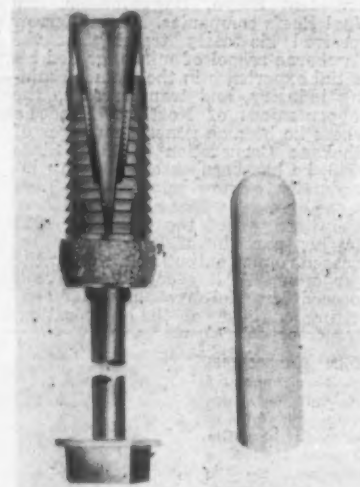
PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



New Model Designations Announced For Eimco 105

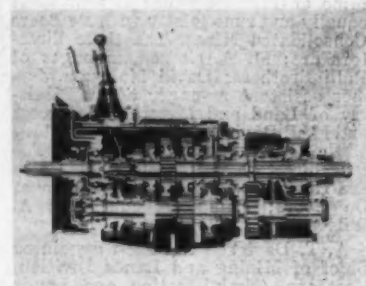
New model number designations for machines in the Eimco 105 crawler-tractor series were announced by the Eimco Corporation. Many attachments are available for the basic Eimco 105, but those newly designated with separate model numbers are machines that require special engineering and manufacturing techniques to take the normal year in and year out stress of heavy duty operation. New series numbers are: Model 105—tractor-excavator, dozer, excavator-dozer combination; Model 115—steel mill excavator; Model 125 front end loader and fork lift; Model 135—steel mill front end loader. For further information circle No. 21.



Resin Bolting Process Multiplies Holding Power

Pattin Manufacturing Company has developed a revolutionary new roof bolting method according to reports. Main advantage say company spokesmen is that many soft failing roofs can now be bolted where formerly they couldn't. This patented method is known as the Air Seal

resin process, and it is said to be valuable for use in headings that must be kept open over long periods of time. The above photo shows a standard Pattin roof bolt with special sealing gasket and washers added, along with a container of plastic resin. The container is simply inserted into the bolt hole ahead of the expansion shell and bolt, and pushed into place. The container is crushed between the shell and the end of the hole when bolt is tightened. The resin flows over, around and into the shell and surrounding strata—but can not run down the bolt if gasket is used. It solidifies into tough, adhesive mass with multiplied holding power. For details circle No. 12.

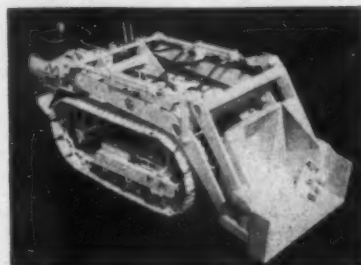


New Transmission For Earthmoving Equipment

Fuller Manufacturing Company announces production of a new heavy-duty semi-automatic transmission designed specifically for big earthmoving and construction equipment. The new model is designated the R-1160. It is engineered for tractors and trucks equipped with engines of up to 1,160 cubic inches of piston displacement. The company reports that the R-1160 is built to give fast work cycles, low fuel consumption, longer engine life, reduced road maintenance and lowered operator fatigue. The unit features 9 forward ratios. Circle No. 15 for details.

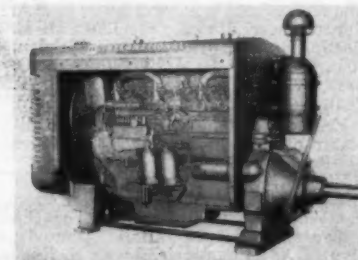
Large Downhole Drill Can Bore 9-Inch Blastholes

A new large Downhole drill weighing 460 pounds and using a Carset bit weighing 126 pounds has been added to the line manufactured by Ingersoll-Rand Company in the United States. The new heavy duty machine can put down 9-inch diameter holes for quarry operations or open pit mines. The air-powered drill is smaller in outside diameter than the hole and it follows the bit into the ground yielding these advantages: no power is lost through rods and couplings and the hammer blows strike the bit directly. Cuttings are exhausted by air. The model number of the new drill is DHD 500. It is designed for use with the Ingersoll Rand Quarrymaster mounting. Circle No. 30



New Air-Powered Loader For Underground Duty

A front-end, air-powered loader and dozer for underground and surface work has been introduced by Machinery Center, Inc. of Salt Lake City, Utah. The unit is designed to dig, bulldoze and dump at all levels. It performs under headings as low as 4 feet, and provides exceptional reach up to 6-foot dumping heights. The crawler loader is powered by a 15 horsepower, reversible, air motor. The machine is equipped with hydraulic steering clutches and hydraulic bucket control. A feature is simple conversion to a full dozer unit. Bucket capacities offered in four models are $\frac{3}{8}$, $\frac{1}{2}$ and 1 cubic yard. For added information write the company or circle No. 17.



International Harvester Adds Four New Diesels

International Harvester has added four new Diesel models to its expanding line of power units. New models are designated UD-554, UD-370, UD-282 and UD-236. The six cylinder UD-554 develops 121 net horsepower at 1,800 rpm and the four cylinder UD-370, 80 net horsepower at the same rpm. New aluminum alloy pistons with chrome plated top rings give the UD-554 and the UD-370 a 16.5:1 compression ratio. The other two models of the new line—the UD-282 and UD-236—are six-cylinder, direct start models. The UD-282 develops 85 net horsepower at 2,400 rpm and the UD-236, 64 horsepower. Write the company at 180 North Michigan Avenue, Chicago 1, Illinois for details or circle No. 20.

PARTS REPLACEMENT for crusher users can be expedited by a manual completed on an IBM machine which shows at a glance what parts are interchangeable on various Allis Chalmers machines of the same type. The manual lists a catalog number, quantity, description and the Allis Chalmers part number for every part of a customer's crusher. It is available to users of Allis Chalmers crushers. Circle No. 41.

CONVEYOR IDLERS: Link-Belt Company has published a new book entitled *Belt Conveyor Idlers*, Book 2716. It contains detailed engineering selection data on five new series and 23 types of idlers. Circle No. 42.

CRUSHERS: New bulletin 58-D by Kennedy Van Saun describes 10 sizes of gearless gyratory reduction crushers varying from 9½ to 83½ inches, and in horsepower from 2 to 250. Capacities range from 1 to 950 tph. Circle No. 43.

DREDGE BULLETIN: Six basic types of dredges are described and illustrated in a new 12 page illustrated bulletin, #933, offered by the Ellicott Machine Co. Photographs, line-drawings and appropriate text detail the various types of dredges. Much information is also included on numerous applications. For your copy circle No. 1.

UNIMOG: This is the name of the new Daimler-Benz Utility vehicle. Featuring a four-wheel-drive, and weighing approximately one ton, the unit can haul a payload of 2,200 pounds. The Unimog is unique in that a large variety of attachments may be fitted to the machine. Among them are: a compressor, generator, crane, dump body, trenching machine, grader blade and many others. For descriptive booklet circle No. 34.

PIPEWALL THICKNESS GAUGE: Here's a new, lightweight portable gauge, capable of measuring a pipewall thickness regardless of pipe diameter. The instrument is accurate, sensitive and measures quickly and nondestructively. Send for brochure recently published by Industrial Nucleonics Corp. Circle No. 5.

INFORMATION ON John Deere "440" Industrial Tractors is now available from the company. Available in both crawler and wheel types, the new units feature new styling, long-life construction, operator comfort, and all-around economy. For the whole story circle No. 8.

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Also send further free information on the equipment advertised on pages:

Pages Product Manufacturer

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NEW REAGENT for solvent extraction is announced by General Mills, Inc., Chemical Division. Alamine 336 is insoluble in water, does not disperse in water, is soluble in most organic solvents, and forms an amine sulfate salt on contact with sulfate liquors. Circle No. 32 for details.

AUTOMATIC ANALYSIS in a continuous system is described in a new 8-page brochure available from Technicon Controls, Inc. The AutoAnalyzer can analyze trace materials down to parts per billion and continuously record results with an accuracy of one percent. In the laboratory Technicon describes the unit as a robot chemist; in the plant it is used for on-stream quality controlled production. Circle No. 33.

ION EXCHANGE RESIN that has just been developed by The Dow Chemical Company is said to demonstrate high selectivity for heavy metal cations. The product is called Dowex Chelating Resin A-1. It is the first chelating resin to be made commercially available. The resin can be used to remove traces of heavy metals from a wide range of product streams. Circle No. 35.

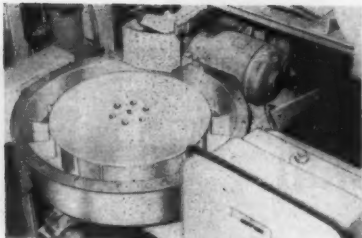
PORTABLE SUBMERSIBLE PUMP is described in literature now available from Stenberg Manufacturing Corporation. Model No. is B-150/200L. It has a maximum capacity of 3,000 gpm and will pump to a maximum head of 220 feet. Circle No. 36.

NEW EXPLOSIVES BAG has been developed by Bemis Bro. Bag Company for packaging industrial explosives mixtures. The bag, sometimes used in combination with a shock-absorbing bag, is constructed of a 3-ply (multi-ply creped kraft paper) outer tube and a specially extruded and seamless polyethylene inner liner. Circle No. 37.

SOILS ENGINEERING: Purpose and scope of soils engineering is the subject of a 16-page report published by Mobile Drilling, Inc. The report explains how this science is used to provide contractors and builders with data. The reader is taken through a typical sub-surface exploration project including drilling, sampling and testing. Circle No. 38.

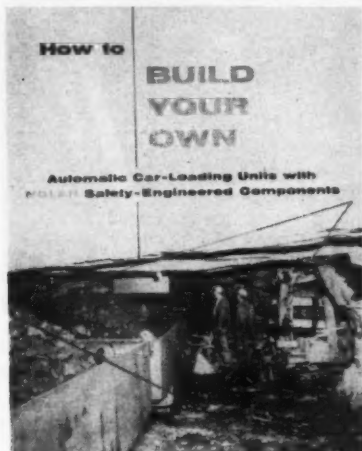
BATTERY CHARGERS made by Syntrol Company have been improved to include the choice of silicon or selenium rectifiers. Previously the units were only available with selenium rectifiers. Circle No. 40.

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S-A Announces Continuous Weigher-Feeder System

A continuous weigher and gravimetric feeder system said to provide extreme accuracy in automatic feeding has been developed by Stephens-Adamson Manufacturing Company. The weigher consists of a circular trough through which pass a series of flights attached to a rotating plate. The flights convey the materials through a 300° arc from entrance to exit points. The control system for the weigher is adaptable to the standard 3 to 15 psi pneumatic air signal control of mechanical system. The weigher can be adapted with control equipment to operate as a gravimetric feeder with a high degree of accuracy. S-A reports that the system can be installed without requiring extensive plant alterations. Full details are available in Bulletin 958, Stephens-Adamson Co., Aurora, Illinois, or circle No. 18.



How To Build Units For Automatic Car Loading

The Nolan Company in Bowerston, Ohio, has published a new free booklet showing how mining companies can build their own automatic car loading units. It was prepared because of Nolan's recognition of the desire and need for savings in operating costs on the part of mining companies. Nolan is therefore offering components either for completed automatic loading station units or to supplement any structural parts the mine personnel may want to build in the mine shops from Nolan plans. The booklet describes in detail many automatic loading station components such as hopper and fly gate, car change switch assembly, automatic control panel, and derail and out-of-car control. Much of this material can be fabricated or assembled by the operator from Nolan-engineered drawings and plans. Circle No. 31 for a copy.

Notes From The Manufacturers

Edward J. O'Connell has been named executive assistant to Charles F. Skinner, vice president and general manager of Western-Knapp Engineering Company. He will serve as liaison between planning, administrative, and operating segments of WKE's world-wide design, engineering, and construction organization. Prior to joining WKE, he was with WEMCO, a division of Western Machinery Company, as sales engineer in New York and San Francisco.



C. J. MOORE has been appointed to the newly created position of general sales and marketing manager of Exide Industrial Division, The Electric Storage Battery Company. Mr. Moore, who has been Exide's sales manager for the past five years, thus assumed direct responsibility for all national sales and marketing activities for Exide industrial batteries, battery-charging equipment and related components. He will continue to make his headquarters in Philadelphia.

The National Iron Company, Duluth, Minnesota, a manufacturer of material-handling equipment for the mining industry, recently announced its affiliation with Pettibone Mulliken Corporation of Chicago, Illinois. Their offices will remain in Duluth, as announced by their president, Lewis C. Erickson. E. J. Selfert is president of Pettibone Mulliken Corporation.

Nordberg Manufacturing Company of Milwaukee, Wisconsin recently announced the appointment of Robert C. Meaders as assistant manager of the Mining, Crushing and Process Machinery Division. Mr. Meaders was vice president of Aerofall Mills, Inc., Columbus, Ohio prior to joining Nordberg. Other appointments made by Nordberg were: D. A. Cheyette, Division vice president, who was also named executive director; and Jack B. Bond, who was promoted to general manager of this Division.

CHARLES F. SKINNER has been named vice president and general manager of Western-Knapp Engineering Company. Mr. Skinner has directed WKE's world-wide engineering, design and construction services as general manager since 1955. After receiving

his Master's Degree in engineering from Stanford University in 1936, Mr. Skinner joined the engineering department of Western Machinery Company. In 1940 he became eastern district manager and later assistant manager. He served as European representative for the company in 1950 and 1951.



27

TYPES AND SIZES

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KREBS CYCLONES handle more than 90% of all U. S. uranium tonnage



THE ANACONDA COMPANY (NEW MEXICO OPERATIONS) has 48 Model D4B Krebs Cyclones. In photo above, installation of these cyclones together with Model D10B primary cyclones for slime removal ahead of mechanical rake classifiers decreased the solution to ore ratio from 2.75 to 2.25 to 1 on an ore high in slimes. Although this arrangement of cyclones and rake classifiers is used primarily to improve solution ratio, this increases viscosity, but there is almost a complete rejection of the plus 10 micron sizes into the fine sands.

Prior to installation of Krebs Cyclones in the various uranium plants, full unit scale studies were made in our Palo Alto pilot plant. These facilities are now being expanded to serve you better.

EQUIPMENT ENGINEERS INC.

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TOURNAPULL REAR-DUMPS: Available in 3 heavy-duty sizes for dependable off-road hauling. B Rear-Dump carries 35 tons (31.7 met. tons), choice of 300 hp diesel engine with sliding-gear transmission, or 335 hp engine with torque converter. Top forward speed is 30 mph (48.2 kph). C Rear-Dump has 22-ton (20-met.-ton) capacity; 210 hp diesel engine with sliding-gear or constant-mesh transmission. Travel speeds are as high as 32.1 mph (51.6 kph). D Rear-Dump carries 11 tons (10 met. tons). Its engine is rated at 138 hp. Manual transmission is standard. Machine travels at forward speeds to 29.5 mph (47.4 kph).

TOURNAPULL SCRAPERS: Scrapers for Tournapull prime-movers are available in 3 sizes: B Fullpak, 27 yd³ (20.6 m³) capacity; C Fullpak, 18 yd³ (13.7 m³); and D Tournapull, 9 yd³ (6.8 m³). These scrapers are interchangeable with Rear-Dump, Bottom-Dump, Flatbed, or lift-and-carry Crane.



These mining machines will help reduce your operating costs

For the exacting requirements of mining, you need strongly built, dependable machinery. And for minimum costs, you need fast-working machinery as well. Strength, dependability, speed and effective use of power are built into every unit of the LeTourneau-Westinghouse line: Tournapull scrapers, Rear-Dumps, Tournatractors, and Adams model graders.

Check the economical production ability you get with these modern machines. Study the specifications. Ask for complete facts on the type of units which can be used profitably in your operations.



C TOURNATRACTOR: This 210 hp, rubber-tired tractor travels anywhere under its own power, at speeds to 17.2 mph (27.6 kph) forward, and to 7.2 mph (11.5 kph) in reverse. Attachments include: dozer blade, Angledozer, root rake, push-block, power-control-unit, winch, side boom, tree stinger, rail coupler, and snow plow. Tournatractor tows sheep-foot rollers, scrapers, rooters and other equipment.



ADAMS MODEL MOTOR GRADERS: These are available in seven models, with hp from 60 to 190. Standard models of heavy-duty type have eight forward speeds to 26 mph (41.8 kph), four reverse speeds to 13 mph (20.9 kph). A gear assembly for three extra low speeds is optional. The POWER-Flow 660 has 190 hp engine with torque converter. It has forward speeds to 27.4 mph (44 kph). The LeTourneau-Westinghouse POWER-Flow 550 has 135 hp with torque converter. The handy 60 hp "220" has forward speeds to 18.3, reverse to 3.2 mph. Attachments for grader line include: snow plow, wing, "Snow-Blow" attachment for wing, scarifier, power-shift moldboard, bulldozer, rotary snow plow, and Jebco Elegrader (for sidcasting materials). The LeTourneau-Westinghouse Adams Model Traveloader picks up windrowed material for casting into trucks.

POWER-Flow, Tournapull, Tournatractor, Angledozer, Fullpak—Trademark Reg. U.S. Pat. Off.; Adams—Trademark LA-1796-M-1m



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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Chile's largest nitrate producer speeds operations with rubber-tired earthmovers

The Anglo-Lautaro Company of Pedro Valdivia and Maria Elena, Chile's largest nitrate producer, uses a fleet of 8 fast LeTourneau-Westinghouse earthmovers to speed up the mining and processing of its mineral product. Illustrated here are some of the jobs handled by their 4 Tournatractors, one C Tournapull with 13.7 m³ (18 yd³) Bottom Dump, and Adams model 660 motor grader, and 2 earlier-model 610 Adams graders.

Ask for complete information

High-speed LeTourneau-Westinghouse scrapers, haulers, graders, and rubber-tired tractors can help you cut costs on mining, plant, yard stock-pile and road maintenance, as well as on stripping and earthmoving construction projects. Write for complete details.



Powerful 160-hp Adams model 660 motor grader, along with Tournapull Bottom Dump, repairs road between plants. With 15-speed transmission, this motor grader provides a balance of power and speed to handle every grading job, in any material, at top efficiency.

As mining operations move on to a new section of the pit, 27.6 km (17 mph) Tournatractor quickly builds new rail bed so that tracks can be laid into the area. (Shovel-loaded ore cars are towed over these rail lines to processing plants.) In addition to building rail beds, Tournatractors are used for scattered dozing and shovel clean-up assignments. These rubber-tired tractors drive anywhere under their own power, eliminate all expense and delay of truck-trailer transport.



Electric-control C Tournapull Bottom Dump hauls earth from borrow pit to build walls for solar-evaporation ponds. The Anglo-Lautaro Company uses these 182 m³ (600 ft³) ponds to produce its nitrate concentrate. A mixture of water and crushed nitrate is pumped into the ponds. The sun's heat evaporates the water leaving the nitrate concentrate.



A specially designed auger attached to the front bolster plate of this Adams 610 model grader agitates the nitrate ore deposit in the solar-evaporation ponds. A large electric pump mounted behind the grader's front wheels sucks up the loosened mineral from the pond floor and forces it through a flexible hose to the processing plant. Tournapull, Tournatractor—Trademark Reg. U.S. Pat. Off. Adams—Trademark GCT-2044-MJ-lp

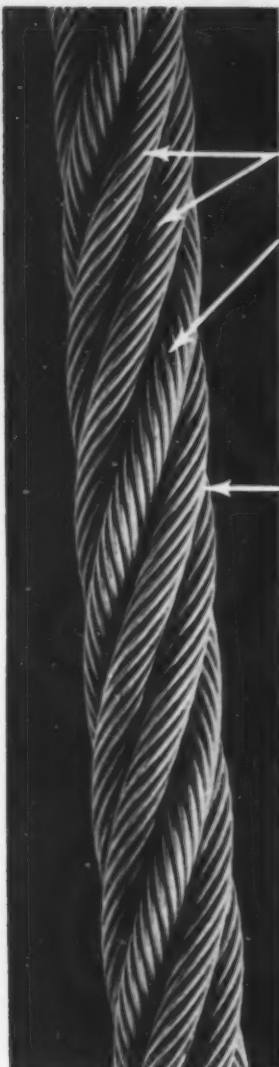


LETourneau-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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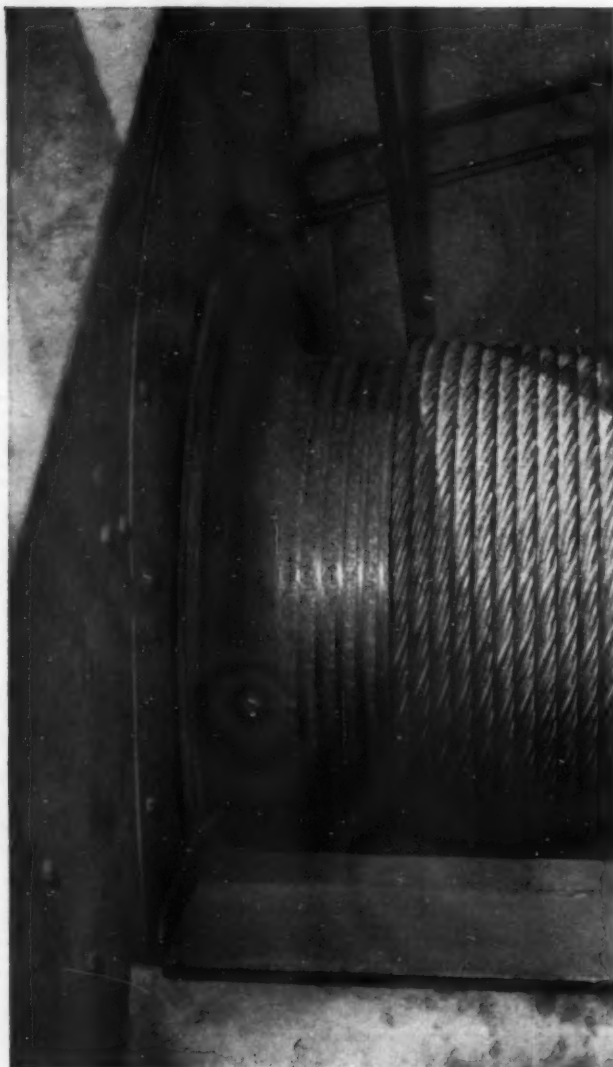
Factories in Sydney, Australia; Campinas, Brazil; and the United States of America



Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristic.

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This company continues: “We have been using your Roebling Herringbone* for about one year. We find it is one of the best ropes we have ever used, outlasting previous ropes three to one. It is good that such a reliable rope is available.”

This is a direct field quote on the most remarkable development in wire rope in years . . . a new concept in wire rope design. Roebling Herringbone is the regular lay and Lang lay wire rope—two-ropes-in-one rope—combining the best features of both.

Herringbone delivers extra flexibil-

ity, extra abrasion resistance, unusual structural stability, extra resistance to shock, easy operation over sheaves and drums and smooth spooling properties.

We recommend Herringbone without reservation for general hoisting and the entire range of heavy-duty equipment. Your Roebling Distributor or Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, will give the full and fabulous details. *Reg. App. For

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precipitates—ROCKY MOUNTAIN—

COLORADO

Rico Argentine Mining Company at Rico, Colorado has resumed mining of lead and zinc and has reopened its flotation plant. The company had been concentrating on pyrite for the past year and a half because of the low metal prices. The lead concentrates will go to International Smelting & Refining Company's smelter at Tooele, Utah, and the zinc will go to Anaconda Company's refinery at Great Falls, Montana.

The U.S. Atomic Energy Commission at Grand Junction, Colorado estimates that the value of its 23 uranium processing mills in the eight western states is about \$134,928,000. The rated producing capacity of all the mills is approximately 21,065 tons per day. Except for the government-owned mill at Monticello, Utah, these are all privately owned and operated, and are all licensed to buy uranium ore from producers. The mills are located in Colorado, Wyoming, New Mexico, Utah, Arizona, South Dakota, Oregon, and Washington.

Knight Mining Company completed a portion of its DMEA lead-zinc drilling program at the New York mine, Breckenridge district, Colorado during the summer of 1958. Since winter weather forced a shutdown of drilling, a crew has been engaged in cleaning out and retimbering the New York tunnel. An evaluation of the data is being made to determine proper exploration work next spring. Melbye and Merwin, consulting geologists of Golden, Colorado, are supervising the project.

An interesting exploration project is progressing on Mt. Shavano near Poncha Springs, Colorado by Gold Eagle Mining Corporation of Salt Lake City. An adit is being driven to find the source of high-grade fault-drag boulders of copper-lead-zinc-silver ore found in a nearby 160-foot shaft completed by the company in 1958. Electrical geophysical methods have been extensively employed due to thick glacial till cover. Melbye and Merwin, consulting geologists and geophysicists of Golden, Colorado, are in charge of the work.

Clear Creek Mining Company reportedly has been formed at Idaho Springs, Colorado to rehabilitate old gold, lead, and zinc properties there. Donald

F. Farris, president, is associated with Ventures Ltd. of Canada, and the latter is said to be putting up some of the money.

The old Gold King mine at Gladstone, near Silverton, Colorado, is being explored for future production possibilities. A trial shipment of ore has been mined from a new stope on the 7th level and shipped to the United States Smelting Refining Mining Company's Midvale, Utah mill for testing. The mine was once a big producer in the state, but no actual mining has been done there in many years. Al Freeland is in charge of the present program.

UTAH

Utah Minerals Company has leased the 75-ton-per-day flotation mill of Sun-Star Mining Company in Salt Lake City, Utah and plans to process lead-silver-zinc dumps from the Park City district.

Rare Metals Corporation of America has leased copper properties near Milford, Utah from U-Beva Uranium Company and will undertake exploratory drilling. The properties formerly were leased to Ogden Smelting and Refining Company of Ogden.

Delhi-Taylor Oil Corporation estimates its potash reserves on its property at Cane Creek, Grand County, Utah as "sufficient to supply production of 1,500 tons per day for 40 years." The property is not yet in production, and it has been reported that the company is currently negotiating with another firm for possible development.

International Smelting & Refining Company, wholly owned subsidiary of Anaconda Company, has acquired the slag dump and 31 acres of ground at the site of the old lead smelter of American Smelting & Refining Company in Murray, Utah. Price has not been disclosed. W. J. McKenna, manager of operations for International, estimates that the slag dump contains approximately 1,250,000 tons of slag, with a zinc content of from 4 to 7 percent. The dump contains very little lead and virtually no other recoverable metals. Slag tonnage will be treated in the Tooele

zinc-fuming plant of International Smelting. Wells Cargo, Inc., contract miners and haulers of Reno, Nevada, were awarded the contract for "mining" the slag. The slag will be moved from Murray to Tooele by rail.

WYOMING

Three companies active in the Shirley Basin area of central Wyoming have reported major new uranium ore discoveries. They are Utah Mining Corporation, Tidewater Oil and Mining Company, and Kermac Nuclear Fuels Corporation. Proven reserves total over 5,000,000 tons of high-grade ore (0.50 to 1.00 percent U_3O_8). Utah Mining controls the largest portion of these reserves and plans an immediate shaft sinking program to a 400-foot depth. The area is about 50 miles south of Casper. Ore with first discovered there in 1954 by Teton Exploration Drilling Company. In July 1957, Tidewater staked a large number of claims, and Utah Mining followed suit. Kermac controls the shallow, up-dip, south end deposits which reach a depth of over 500 feet on the north end, down-dip claims reportedly owned by F. Simons.

The office of Phelps Dodge Corporation in Lander, Wyoming which has been temporarily closed will be reopened shortly. Elton Clark, in charge of the office, was transferred to company headquarters at Douglas, Arizona to work out engineering details of Wyoming property being developed by Green Mountain Uranium Corporation, a PD subsidiary. The whole project awaits completion of a new milling contract between the AEC and the Western Nuclear Corporation mill at Jeffrey City, Wyoming to which Green Mountain will ship.

Mountain High Uranium and Oil Corporation is considering the construction of a mill or upgrading plant near Linch, Wyoming, in Johnson County. President Noel Edgington said that work is under way to stockpile 1,000 tons of uranium ore near Linch. The company is reported to be developing ore on 249 claims in the Pine Ridge area, several miles west of Pumpkin Buttes, another uranium producing area.

United States Mine Production of Uranium Ore in Short Tons by States for AEC's Fiscal Years 1956, 1957, and 1958

States	FISCAL YEAR 1956				FISCAL YEAR 1957				FISCAL YEAR 1958			
	First Six Months		Second Six Months		First Six Months		Second Six Months		First Six Months		Second Six Months	
	July-Dec. 1955		Jan.-June 1956		July-Dec. 1956		Jan.-June 1957		July-Dec. 1957		Jan.-June 1958	
	Tons	% U ₃ O ₈	Tons	% U ₃ O ₈	Tons	% U ₃ O ₈	Tons	% U ₃ O ₈	Tons	% U ₃ O ₈	Tons	% U ₃ O ₈
Arizona	92,588	0.25	121,059	0.25	155,077	0.24	148,919	0.26	137,234	0.27	143,278	0.31
Colorado	174,027	0.31	218,359	0.30	276,846	0.30	319,648	0.27	419,946	0.25	422,460	0.30
New Mexico	157,735	0.23	488,362	0.26	616,821	0.27	601,475	0.22	586,403	0.21	759,485	0.22
Utah	353,130	0.31	419,018	0.31	507,090	0.33	510,408	0.35	565,493	0.35	622,090	0.37
Wyoming	41,358	0.22	57,425	0.23	99,239	0.22	48,686	0.24	225,856	0.21	293,009	0.23
Washington, Oregon & Nevada	5,444	0.30	3,730	0.29	3,008	0.33	662	0.32	57,099	0.16	77,203	0.16
North Dakota-South Dakota	13,994	0.18	9,999	0.19	25,991	0.19	42,547	0.16	27,253	0.17	20,456	0.20
Others (Texas, California, Montana)	495	0.21	2,388	0.19	1,717	0.40	1,244	0.37	2,589	0.69	3,810	0.77
Totals	838,771	0.28	1,320,340	0.28	1,673,589	0.28	1,673,589	0.27	2,021,873	0.26	2,341,791	0.28

Traylor-made rotary kilns

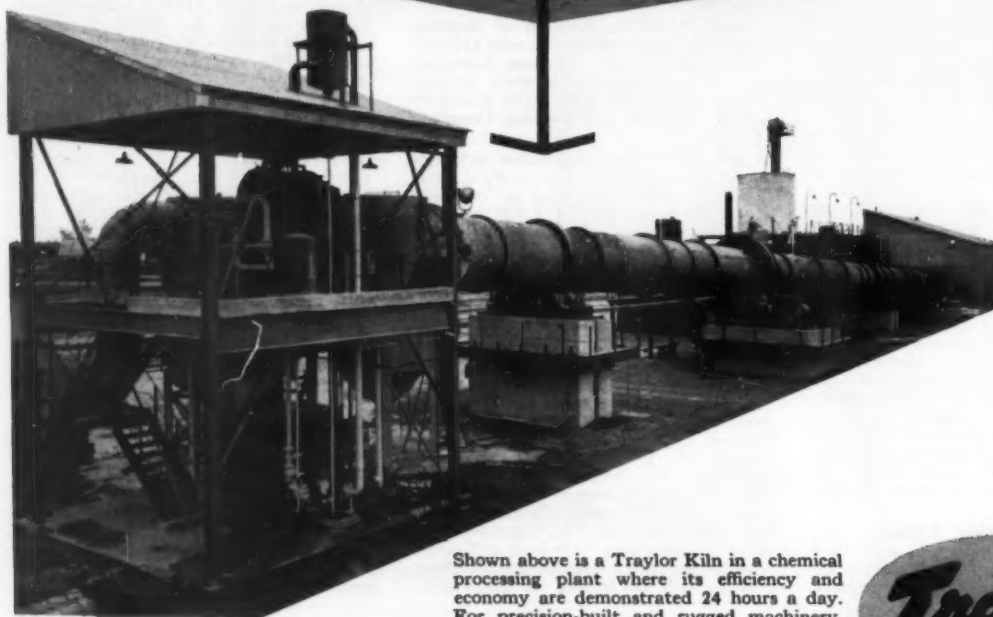
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8'-0" x 150'-0" Rotary Kiln in a portland cement plant.



12'-0" x 325'-0" Rotary Kiln in a chemical plant.



Shown above is a Traylor Kiln in a chemical processing plant where its efficiency and economy are demonstrated 24 hours a day. For precision-built and rugged machinery, call on Traylor Engineers today. Write for Bulletin No. 1115 for more on Traylor Kilns.

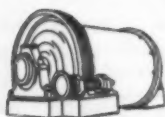


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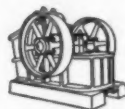
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APRON FEEDERS



PRIMARY GYRATORY CRUSHERS



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SECONDARY GYRATORY CRUSHERS

ARIZONA

Kennecott Copper Corporation's Ray Mines Division in Arizona is undertaking a number of construction projects. Work to be done includes general yard facilities, such as a portable water supply, fire protection system, sewage disposal plant with collecting lines and mains, roads, paving, storm sewer, compressed air lines, and electrical distribution; a general shop building; heavy truck repair garage; a warehouse; a tire and rubber storage building; and a guard house. At Hayden there will be construction of the Ray mill and smelter ancillary buildings, along with site preparation. Work to be done here includes a general shop and boiler shop; a warehouse; and a sample preparation building. Site preparation includes grading of new roadways and completion of existing roadways, a section of standard gauge railroad, paving of roads and parking lot, the installation of utilities lines (water and sanitary sewer), a scale house, scales, sampling and miscellaneous items of site and yard work.

Inspiration Consolidated Copper Company's mines at Inspiration, Arizona are now producing copper at a rate of about 42,500 tons a year. The mines had been on a five-day week during the first three quarters of 1958, but returned to six-day operation in the final quarter of the year because of increased demand.

The Cordilleran Section of the Geological Society of America will hold its 55th annual meeting on the campus of the University of Arizona at Tucson April 2 through 6. Hosts of the meeting will be the University, Arizona Geological Society, and the Arizona Academy of Science.

An investigation to identify and locate the owners of an estimated 13,000 mining claims on the Papago Indian Reservation of central Arizona is now under way by the U.S. Bureau of Land Management. It is estimated that only about 15 percent of the claims will be identified, and title to any of the remaining is expected to be liquidated thru advertising and procedures provided by federal law. The work is made necessary by Public Law 47, which withdrew the Indian lands from mineral entry and made them the sole property of the tribe. The work is expected to be completed by June 1961.

CALIFORNIA

A pilot H-iron plant, the first of its kind on the West Coast, is to be built by the Bethlehem Pacific Steel Corporation in the Los Angeles area of Southern California. It will produce small quantities of crude metallic iron through a direct reduction process which utilizes hydrogen at relatively low temperatures and high pressures to remove the oxygen from the iron ore. Facilities needed will include drying and grinding equipment for processing the iron ore, reactors in

which the iron ore is reduced by the hydrogen passing through it, a unit to manufacture the hydrogen, and machinery to convert the crude metallic iron into briquettes for electric furnace use. **Hydrocarbon Research Inc.** has engineered the outdoor plant to comply with Los Angeles County air pollution regulations.

Phelps Dodge Corporation has withdrawn from its joint venture with **Shasta Minerals & Chemical Company** of Salt Lake City. The project was to explore for copper, zinc, and pyrite in California's West Shasta district north of Redding. The properties included the **Shasta King**, **Sugar Loaf**, and **Balakalala** mines. Shasta plans to continue the drilling program this spring. Part of the program will be done with the aid of a DMEA loan contract not yet completed.

The **United States Geological Survey** has published a geologic map (MF-204) of the boron quadrangle, Kern and San Bernardino counties, California. The scale is 1:62,500 (1 inch equals about 1 mile); contour interval, 20 feet. The price is 50¢ and copies may be ordered from the Superintendent of Documents, Washington 25, D.C.

Dorr-Oliver Inc. has moved its filtration engineering and development operations from Oakland, California to new international headquarters in Stamford, Connecticut. Engineering and manufacture of such items as cyclones, centri-

fuges and pumps will continue to be carried out at Oakland.

NEVADA

Goldfield Engineering Associates of Las Vegas Nevada has gone into production at its **Prospector's Friend** property on Columbia Mountain at Goldfield, Nevada. Columbia Mountain is a 400-foot peak at the north end of the main producing area at Goldfield. In the early 1900's, an adit was driven several hundred feet into Columbia Mt. from the south side, but further exploration was never carried out. About 300 feet from the portal of the adit, Goldfield Engineering is now driving a lateral to the west to a point below a 400-foot by 700-foot surface showing, so that the ore body may be mined by stoping. The firm expects to ship to the former **Newmont Mining Corporation's** cyanide plant located on the old Florence property. If this does not work out, the company will then discuss arrangements with the **U.S. Milling and Minerals Corporation** at Silver Peak, Nevada.

Kennecott Copper Corporation's new \$1,500,000 skip haulage system for re-



\$5,000,000 Expansion for Phelps Dodge Pit

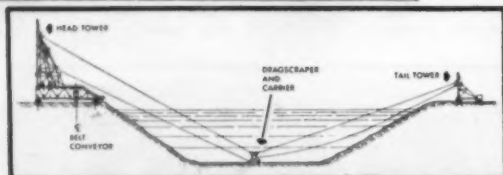
Phelps Dodge Corporation has started a \$5,000,000 expansion program which will extend the operational life of its Lavender Pit copper mine at Bisbee, Arizona. Though daily production is not expected to increase, the life of the pit will now be 15 years. The project was first undertaken in 1951; production started in 1954. The pit is now 300 feet deep; when expansion is completed, the depth of the pit will be an average of 800 feet. Generally, pit expansion will be south toward the Junction Shaft. The black dotted line indicates the new boundary. Several buildings, marked (2) in the photograph, will have to be moved to the vacant area near Lowell Junction (4). These include the general pit office, miners' change rooms, mechanical shops, a railroad transfer loading dock, and other smaller buildings. The power house (3) will not have to be relocated. The small hole in the upper left (1) is the old Sacramento Pit which was largely backfilled with overburden from the Lavender Pit operation.

Tough Digging, Long Hauls... Routine Jobs for Sauerman DragScrapers



240-Ft. Bank... 350-Ft. Haul

This mobile Sauerman Tower Excavator digs 480 yds. per hr. on an average haul of 350 ft. from a high bank to a portable field hopper. The 12-yd. Crescent DragScraper operates between steel head and tail towers. The towers are mounted on two sets of railroad tracks and ride on four sets of trucks. DragScraper power is supplied by two hoists mounted on the head tower. One hoist operates the load and pull-back cables, the other is used to tension the track cable. The hoists are controlled by one operator located in the cab on the tower. The load cable handles over 400,000 tons of material before replacement.

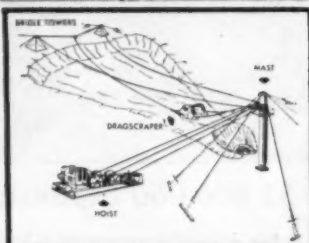


Drawing shows typical mobile tower excavator digging in wet pit.

75-Ft. Under Water... 800-Ft. Span

A 5-yd. rapid-shifting DragScraper supplies about 200 yds. per hr. to the plant hopper in background. Bridle tower in foreground is one of two supporting the bridle shifting cable which is controlled by the third drum of the Sauerman hoist. Lateral shifting of the DragScraper's line of operation is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The DragScraper is digging 75 ft. under water and the operating span is 800 ft. from head frame to the bridle towers. Over a million tons have been excavated from this pit. The DragScraper often operates 24 hrs. a day to handle contract demands.

Diagram shows details of Sauerman rapid-shifting DragScraper.



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SOUTHWEST

removal of ore and waste from the huge Liberty Pit in Nevada is about completed and trial runs are under way by the Nevada Mines Division. The skip track is 1,360 feet long, inclined at about 19°, and vertical lift will be 435 feet. The 25-ton-capacity skips will discharge into two ore bins, each with a level capacity of 100 tons and a surge capacity of 180 tons.

Tonopah King silver-gold mine at Tonopah, Nevada is one of those in the district which have reopened and are shipping to the U.S. Milling and Minerals Corporation at Silver Peak, Nevada. The latter took over the mill from Bruhi interests and modernized and reconditioned it. Present rate of milling is about 200 tons of ore daily.



According to reports, the Clute Corporation of Denver, Colorado expects to place a new mica separation mill in operation in the Santa Fe National Park in New Mexico. The mill is to use a new air separation process and reportedly will be able to recover 36 tons per day from ore containing 20 percent mica. The property is being developed by a Dallas, Texas group headed by John Edd Therrell.

Chino Mines Division of Kennecott Copper Corporation in New Mexico has a number of programs lined up for 1959. At the mine, work has already begun on cutting the slot for the skip system. Underpasses for railroad tracks will be provided on certain levels. The ship system with two large haulage skips should be completed and in use about the middle of 1960. There will be a general relocation of railroad switchbacks from the north to south end of the pit in order to mine the remaining ore body in the most efficient manner, and to tie in with future mining plans. A program has been approved for expansion of precipitation plant facilities, and long range plans for the Hurley reduction plant will be started in 1959.

Olen F. Featherstone of Roswell, New Mexico and Farm Chemical Resources Development Corporation have reached a settlement pertaining to Mr. Featherstone's interest in the potash reserves controlled by the corporation in Eddy County, estimated at 175,000,000 tons. Mr. Featherstone is to receive an undisclosed amount of cash, plus an overriding royalty. The potash deposits were discovered by Mr. Featherstone in 1950 with financial support from National Farmers Union. Farm Chemical is owned jointly by National Farmers Union, Phillips Chemical Company, and Kerr McGee Oil Industries Inc.

At Kennecott Copper Corporation's Chino Mines Division the only large portable rectifier substations ever built are in use at the Santa Rita mine. These substations transform 24,000-volt alternating current into 750-volt direct current to feed the trolley lines and the electric locomotives. The No. 1 unit, located on the 5492 level, serves the pit; the No. 2 unit is located at the new "V" and serves the dumps. Each is capable of delivering more than 1,000 horsepower. They can be moved to new locations when operating conditions require.

The AEC lists 37 New Mexico operations in its list of the nation's uranium ore producers. These shippers and their headquarters are listed as follows: Anaconda Company, Grants; Calumet & Hecla, Albuquerque; Chena Mining Company, Grants; Dalco Uranium, Inc., Grand Junction, Colorado; Febco Mines, Grants; Flat Top Mining Company, Scott City, Kansas; Four Corners Exploration Company, Grants; Haystack Mountain Development Company, Prewitt; Highland Development Company, Amarillo, Texas; Holly Corporation, New York; Homestake-Sapin, Grants; Largo Uranium Company, Gallup; Lone Star Mining and Development, Albuquerque; Mathis & Mathis Mining, Gallup; E. P. Moe, Grants; C. C. Pease Turstee, Sundance, Wyoming; Phillips Petroleum Company, Bartlesville, Oklahoma; Rem Uranium Company, Gallup; Charles N. Pickens, Mancos, Colorado; Rimrock Mining Company, Sturgis, South Dakota; Rio de Oro Mines, Inc., Albuquerque; Rogers & Osborne Mining, Belle Fourche, South Dakota; Shiprock Ltd., Shiprock; Spafford & Son, Farmington; St. Anthony Uranium Corp., Grand Junction, Colorado; Lloyd Sutton, Jr. and Lloyd Sutton, Sr., Grants; Three Jacks Mining Company, Aztec; A. W. Tucker, Albuquerque; Uteco Uranium Company, Denver; Vanadium Corp. of America, Durango, Colorado; Vallejo Uranium Mines, Inc., Grants; W. C. T. Engineering Company, Belen; Westvaco Minerals Development, Pocatello, Idaho; Westwater Corporation, Santa Fe; Zia Mining Company, Grants.

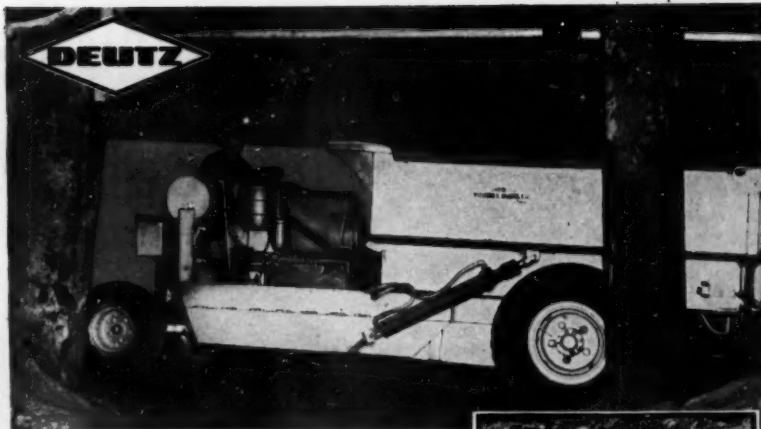
Bright Uranium & Oil Company of St. Louis, Missouri has bought the Carrica uranium mines in the Grants-Poison Canyon district of New Mexico. Operations are underway. The firm also has an option on the Salmar group in the Santa Cruz district from Beacon Exploration Company.

United States Potash Company, division of U.S. Borax & Chemical Corporation, is using two old railroad box cars for warehouses at its Carlsbad, New Mexico operations. The cars were purchased from Santa Fe Railway Company and placed on foundations adjacent to the main line tracks for easy unloading and reloading of borate products.

Three Bells Mining & Milling Company of Lordsburg, New Mexico is producing about 35 tons of gold-silver-lead ore daily at its Spanish Miner Project, 17 miles northeast of Lordsburg. A 50-ton cyanide plant is located at the site of the underground operations. Leslie J. Reagan is president and general manager.



Reynolds Metals Company has completed an enlargement of the Sherwin plant at Corpus Christi, Texas and it is now capable of producing more than 700,000 tons of alumina per year. Reynolds built the original facilities in 1952-1953 with a capacity of 1,000 tons per day in two 500-ton sections. The third and fourth units, also rated at 500 tons each, went into operation in November 1957 and November 1958, respectively.



Utah Mining Truck Manufacturer Picks AIRCOOLED DEUTZ DIESELS for its Shuttle Buggies

The strenuous demands made on its mining trucks in the uranium country of the four corner area determined the selection of Deutz Air-cooled diesels by the Young's Machine Company in Monticello, Utah. Picking the quick-starting Deutz with its high fuel economy, no overheating and maintenance problems proved an invaluable aid in increasing sales for Young's.

In picking Deutz Air-cooled diesels Young's Machine Company joins a long list of American and foreign manufacturers in specifying the world's outstanding air-cooled diesel for their equipment. Only Deutz has these outstanding features:

- A full range of Aircooled Diesels from 5 to 310 BHP in 1, 2, 3, 4, 6, 8 and 12 cylinders, all with individual cylinder units and interchangeable heads.
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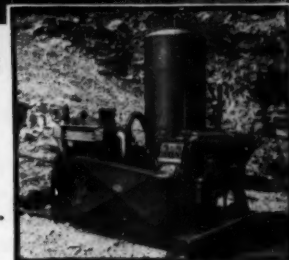
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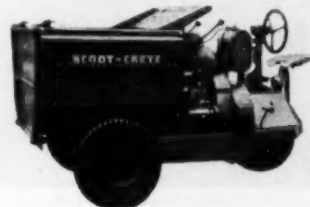
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Mine installation at Rock Springs, Arizona, uses ATLAS COPCO Compressor CT-6 with Deutz-6 cylinder A 6L 514 engine to assure top running efficiency in all temperatures. The semi-portable compressor provides 320 C.F.M.



GETMAN BROTHERS picked Aircooled Deutz Diesel Engines to power its Scoot-Crete Ore Carriers designed to carry loads up to 3500 lbs. and climbing 25° grades. Deutz was chosen for reliability, high fuel efficiency and minimum downtime.

PARTIAL SPECIFICATIONS TABLE

MODEL	BHP	RPM
F 1 L 712	10/12	2000/2300
F 2 L 712	20/24	2000/2300
F 3 L 712	30/39	2000/2300
F 4 L 712	40/52	2000/2300
F 6 L 712	60/78	2000/2300
A 2 L 514	28	1800
A 3 L 514	42	1800
A 4 L 514	56/72	1800/2000
A 6 L 514	84/110	1800/2000
A 8 L 614	112/145	1800/2000
A12 L 614	170/220	1800/2000



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Bunker Hill Awards Plant Design Contract

Bunker Hill Company has selected Dorrell Inc. of Stamford, Connecticut to undertake preliminary engineering, process design, and layout of the new \$10,000,000 fertilizer plant scheduled for the Pacific Northwest. Actual site location is still being studied, but construction is still scheduled to begin later this year, with operations planned for early 1960.

The large fertilizer project is expected to include two silos for phosphate rock storage; the phosphoric acid plant where phosphate rock and sulfuric acid will be mixed; a dry fertilizer plant where both ammonium phosphate and triple superphosphate fertilizers will be produced; dry storage warehouse for storing finished fertilizer products in bulk; and a bagging and shipping department.

Northern Milling Plans New Flotation Mill

The Northern Milling Company has plans for the construction of a 150- to 200-ton-per-day differential flotation mill at its Marietta mine in Broadwater County, Montana. The company has been a direct shipper of ore to smelters at East Helena and Anaconda, Montana.

W. R. Wade, consulting engineer of Marysville, Montana, has been retained to work out the metallurgy and design the mill. Differential flotation presents a difficult problem because the ore is an extremely fine-grained, complex intergrowth of gold, silver, lead, zinc, copper, iron, and arsenic sulphides. For the most economical recovery the arsenic must be eliminated; also all the copper and no lead and zinc must be in the copper concentrate.

Ore is mined from several veins, five to nine feet wide, cutting andesite. It assays five to eight percent lead, six percent zinc, 0.2 to 0.6 percent copper, and carries good gold and silver values.

Central Farmers Phosphate Plant To Start Next Month

Central Farmers Fertilizer Cooperative's \$16,000,000 phosphate project at Georgetown Canyon, 17 miles north of Montpelier, Idaho, is nearing completion. Limited production at the plant is scheduled to begin about the first of April. By June the firm hopes to have its elemental phosphorus unit in production. Construction has been underway for about two years.

The Central Farmers plant will be one of the most unique in the United States. According to company officials, Central Farmers will market a high analysis superphosphate by using elemental phosphorus. All commercial fertilizers manufacturers in the United States make superphosphates by acidulating phosphate rock. Only the Tennessee Valley Authority has made fertilizer from elemental phosphorus. The Cooperative hopes to end up with a superphosphate containing 50 to 55 percent P_2O_5 , compared with the 40 to 45 percent P_2O_5 content of conventional treble superphosphate.

A strip mine has been opened by Central Farmers on a phosphate rock deposit that dips about 70° in the direction of the slope of the topography. The zone is

about 180 feet wide, including lower grade interbedded phosphatic shales. The overall waste to ore ratio is 2.5 to 1, and the ore is mined in several grades from 18 to 32 percent P_2O_5 . Feed from the mine is delivered to the plant by belt conveyors, and a sizable stockpile has already been built in anticipation of the start of operations at the plant.

The plant will contain beneficiation facilities which will include washing, screening, desliming cyclones and Dorco Fluosolids reactors. This section of the plant will treat roughly half of the phosphate rock. The other half of the mine run ore will form the feed for the elemental phosphorus section. Elemental phosphorus and ground, beneficiated phosphate rock will be combined to make the high analysis superphosphate product.



The new uranium area northeast of Stanley in Custer County, Idaho had yielded more than 2,000 tons of medium-grade uranium ore up to the end of November when operations generally were suspended until spring. Phillips Petroleum Company, Western Fluorite Mining Company, and Rare Metals Corporation of America have been principal operators. Sidney Mining Company, Kellogg, Idaho, is expected to become more active in the spring at its two properties. Some 250 mining claims have been in a 36-square mile area along a contact between the Idaho Batholith and Challis volcanics. Most of the discoveries were made by William Brooks and Melvin Peterson of Hailey.

American Smelting and Refining Company's Page mine west of Kellogg, Shoshone County, Idaho, is producing at nominal capacity of about 500 tons of ore daily again, following a return to a five-day week from a four-day week. Values are chiefly in lead and zinc. J. C. Kieffer of Wallace is manager of Asarco's Northwest mining department.

Sidney Mining Company has contracted with Nabob Silver-Lead Company to develop the N-bob mine on Pine Creek in the Coeur d'Alene mining region of Shoshone County, Idaho. Sidney is the largest operator and currently the lone producer in the Pine Creek zinc-lead district. Nabob discovered an unknown ore shoot several years ago and partly developed it before closing down in mid-1957 because of low metal prices. The agreement calls for Sidney to install necessary equipment, deepen the Nabob shaft, open a new level, and place the mine in production. Sidney would get 40 percent of profits after recovering its expenditures and have the right to operate its own or adjoining properties through Nabob workings. Malcolm C. Brown, Kellogg, is president of Sidney. H. J. Hull, Wallace, heads Nabob.

A 600,000-pound stockpile of lead mined and stored by Clayton Silver Mines last year when lead was at or below 11 cents a pound has been sold by the Custer County firm at 13 cents a pound. Production was resumed recently following a four-month suspension because of poor marketing conditions and a crew is driving an 1,800-foot drift to the mine's

North ore body on the new 800-foot level. R. J. Legard is resident manager, and Norman Smith, Kellogg, Idaho, is company manager.

A silver-copper ore body in the Galena mine west of Wallace, Shoshone County, Idaho, had been opened over a strike length of 550 feet on the new 4,000-foot level, at last report. Production is about 450 tons of ore daily. The mine is owned by Callahan Mining Corporation and operated under lease by American Smelting and Refining Company. Day Mines, Inc., of Wallace has a 25 percent participating interest in the lease.

Ground of Silver Bowl, Inc., adjoining Kellogg, Shoshone County, Idaho, has been penetrated for 1,000 feet from east to west in an exploratory bore from workings of the Bunker Hill Company. Diamond drilling to the north and south from the lateral will probe for the downward extension of a vein which yielded high-grade silver-lead ore to early-day operators of the Senator Stewart mine. C. Whelan of Kellogg is secretary of Silver Bowl.

Hecla Mining Company has purchased approximately \$4,500,000 worth of Lucky Friday Silver-Lead Mines Company stock from Lucky Friday shareholders at \$7.50 each. The Wallace firm now owns some 600,000 of the 1,306,479 Lucky Friday shares issued. The Lucky Friday mine is the youngest major producer in the Coeur d'Alene mining region of Shoshone County, Idaho. It is just east of Mullan. Newmont Mining Corporation of New York City helped finance the purchases and took Hecla stock in return.

Adams-Winston-Western Syndicate has subleased a 160-acre iron ore property from Frank Milbert and M. L. Darrow of Potlach, Idaho. The two men hold a lease on state land in Latah County. The Duluth, Minnesota firm plans to start shipping ore by spring. Some exploratory work has been done on the lease over the past few years and studies by Adams-Winston-Western have disclosed high-grade magnetic ore. The property is located eight miles south of Potlach.

A clay separation plant is being built one mile west of Bovill, Latah County, Idaho, by J. R. Simplot Company. To be completed first are an office building and a chemical and metallurgical laboratory. Following a year of tests on clays from leased and purchased ground, the company began developing the site last summer. A site was cleared, roads built, a railroad line surveyed, and work started on a water impounding dam. The project is being directed by Phillip T. Peterson of Moscow, formerly with the company's phosphate mining operation near Pocatello.

A track grinding machine which smoothes the ripples out of worn mine rails is cutting maintenance costs in the big Bunker Hill mine at Kellogg, Shoshone County, Idaho. Broken mine car axles now number only about one a month, compared with 16 to 20, formerly. Locomotives and mine cars also last longer. Built in Spokane, Washington for \$5,000, the machine has more than paid for itself since put in service early in 1958. It consists of a 110-gallon water tank and six grinding stones on a four-wheeled carriage pulled by a locomotive. Compressed air regulates the grinding process.

Mining Ventures, Inc. has been incorporated by three Sandpoint, Idaho resi-

NORTHWEST

dents, Fred R. Kennedy, Thornton J. Davis, and Alice W. Hunt. Capitalization was listed at \$25,000.

Beneficiation tests conducted by the Idaho Bureau of Mines and Geology indicate that thorite from Hall Mountain in Boundary County, Idaho will yield concentrates containing up to 30 percent thorium dioxide by tabling. Thorium recovery, however, has been only about 60 percent and the Bureau is working to improve it. Northwest Prospecting and Development Company and Hall Mountain Thorite, Inc. of Spokane, Wash., have been most active on the mountain.



Anaconda Company of Butte, Montana has merged its wholly owned subsidiary, Anaconda Aluminum Company, with two other Anaconda subsidiaries to form a new organization with assets totalling \$140,000,000. The new firm will retain the name of Anaconda Aluminum and will be headed by Archie P. Cochran, president and founder of Cochran Foil Corporation. The two other companies joining with Anaconda Aluminum are American Aluminum Company and Cochran Foil. Executive offices will be in Louisville, Kentucky.

The New Mine Sapphire Syndicate of Billings, Montana is developing vein ex-

posures and reworking old dumps at the Yogo Gulch Sapphire mine near Lewistown, Montana. Present recovery of sapphires is by sluicing methods, but the company plans on constructing a more modern mill in 1959 and greatly increasing production. Past development work has shown that considerable reserves showing good sapphire values exist at the property.

A pilot plant to produce ferrochrome, an alloy of iron and chromium is now in operation at Nye, Montana. The American Chrome Company built this plant to test the feasibility of producing and marketing this material for domestic consumption. Initially the production will be about five tons per day, but it is hoped that the capacity can be increased to 15 tons per day. The plant consists of a mix building for the raw materials and a building which houses the electric furnace.

R. D. Potee, Inc. has been formed in Montana to mine in the Boulder area. Authorized capitalization is \$50,000 and the incorporators are R. D. Potee and John T. Vance, both of Helena, and Fred Nicholson Jr. of Cascade.



Reopening of some of the old workings in the Evening Star Consolidated group

of gold lode claims in the Greenhorn area, Baker County, Oregon, and exploratory work is planned by Francis Murphy of Oak Run, and Richard E. Bixley of Carmel. The claims are near the head of Gimlet Creek.

Yttrium metal, long considered too brittle for structural uses, has been cold-rolled to foil thinness at the U.S. Bureau of Mines' Northwest Electrodevelopment Experiment Station at Albany, Oregon. This was accomplished by ridding the metal of dissolved gases. Because of the metal's relatively high melting point and low resistance to passage of neutrons, it now may find new applications in atomic reactors and missiles.

Hanna's nickel mine and smelter at Riddle, Oregon are steadily producing at the nation's only nickel operation in the United States. Hanna Mining Company is mining the ore body on Nickel Mountain which is 6,000 feet long, 3,000 feet wide, and goes to a depth of 250 feet. The ore is sent down to the smelter of Hanna Nickel Smelting Company by aerial tram. The smelter turns out about 65 tons of ferronickel per day, averaging 45 percent nickel and 55 percent iron.

Scientists at the U.S. Bureau of Mines laboratory at Albany, Oregon have announced the first molybdenum casting in what the Bureau considers a major metallurgical break through in molybdenum technology. Because molybdenum metals at the extremely high temperature of 4,748 degrees F., it has thwarted attempts, until now, to form it into casting because in its molten state it destroyed the crucible. The Bureau metallurgists

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used remote-control methods in an inert atmosphere with a high density electric arc to produce the casting. Climax Molybdenum Company at Climax, Colorado is cooperating in the work, and has agreed to supply the necessary raw materials for the experiments. Climax observers will also attend future experiments; the company feels it is too early to assess the ultimate commercial value of the process.



Utahcan, Inc. has set a mid-April target date for the start of open-pit mining and milling operations at its **Jim Creek District** lead-zinc-silver property in Pend Oreille County, Washington. Work was resumed last October and continued through the winter, with employees living at the mine camp. Concrete was poured for the crusher room during a late December mild spell. Machinery for the 100-ton mill previously had been hauled to the property for winter installation. Frank Wiegler, formerly with the **Bunker Hill Company** at Kellogg, Idaho, is mill superintendent, and Roy Lorang, Spokane, president.

Following successful 1958 tests, **Western Gold Mining, Inc.** plans to put its 150-ton mill into production this year. Company holdings are in the Slate Creek mining district of Whatcom County,

Washington. Amount of production will depend upon road conditions. The present U.S. Forest Service road through Hart's Pass is being reconstructed by the Army Engineers for a radar station on Slate Peak, one mile from the mine. Construction of a \$100,000 heavy media separation plant tentatively has been scheduled for 1960.

Carl A. Coon and associates of Spokane, Washington are purchasing the old **Silver Hill** property four miles south of Spokane from **Spokane Tin Company**, which has owned the deeded ground since 1907. Extensive bulldozing by the new owners has uncovered a number of promising new veins containing both tungsten and tin. Acceptable concentrates have been made from a 500-ton test run in a small jig plant. Additional development work is planned to determine the vertical extent of the mineralized structures. Sillimanite and andalusite also are present over a wide area.

Crude lead ore averaging about 30 percent metal is being mined at the old **Gladstone** mine in Northport district, Stevens County, Washington by A. G. Lotze of Boundary, who has a lease from **Gladstone Mountain Mining and Milling Company** of Spokane. The ore is being taken from a drift off the deepened main shaft. Higher-grade ore shipped previously came from chimneys in limestone. The ore is hauled to the **Bunker Hill Company** lead smelter at Kellogg, Idaho. William H. Swann, Spokane, is president of the Gladstone firm.

Sheffler Mining and Leasing is negotiating with several individuals and firms

on an operating agreement that will develop a uranium prospect held by the firm at **Lamb Creek** in Pend Oreille County, Washington. The property is leased to Edward E. Sheffler of Lone, who heads **Sheffler Mining and Leasing**. The property reportedly contains secondary autunite, curite, gummite, tyuyamunite, and a primary uraninite.

Drilling of uranium showings on leased lands in Stevens County, Washington's Arden and Deer Lake districts is planned by **Blue Star Mining and Survey Corporation** of Colville. Tungsten, iron, and copper mineralization also has been noted. Cline E. Tedrow of Spokane is the firm's mining engineer. Stanley V. Haye Sr., Colville, is president and general manager, and A. M. Hutkoi, Richland, secretary.

Washington's iron ore resources have been investigated by an industrial raw materials advisory committee to the **State Department of Commerce and Economic Development**. Four northeastern Washington counties are said to have deposits which might contain sufficient ore to provide a substantial portion of reserves needed for a smelter. Special attention is called to the **Big Iron**, **Kulzer**, **Reed**, and **Thompson** deposits in Stevens County, the **Buckhorn**, **Roosevelt**, and **Strawberry Lake** deposits in Okanogan County's Chesaw district and to the **Belcher** district in Ferry County. Biggest iron deposits are in the **Blewett-Cle Elum** district of Chelan and Kittitas counties, but they contain nickel and chromium which makes them unsuitable for production of standard steels.

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Minnesota Miners Hear About Russian Iron and Steel; Learn How To Use Automatic Controls

Iron and steel operations in Russia were the general theme of the 32nd Annual Meeting of the Minnesota Section of the AIME held in Duluth, Minnesota, in January. Headliners were three of the industry's top men who had completed a tour of Russia in mid-1958.

E. L. Joppa, general manager of Pickands, Mather & Co., commented that Russian mining methods were considerably behind American methods. He pointed out, however, that the Russian government expected to produce over 100,000,000 tons of ore per year by 1975. This increase would come partially through improved mining methods, six new taconite concentrators, and reserve areas.

D. N. Vedensky, vice president of M. A. Hanna Company, emphasized the apparent success the Russians have had with self-fluxing sinter. He, too, indicated that plant methods would have to be improved considerably if the Russians expect to become the world's largest iron ore producer by 1975. If their goal is reached, said Mr. Vedensky, they will have to export fairly large quantities of ore as their expected steel consumption will not absorb this ore production.

J. H. Strassburger, assistant vice president of Weirton Steel Company, was quite enthusiastic about Russian mining and steel methods, and he indicated that some of these methods were worthy of trial in the U.S. He was particularly impressed with the apparent success of the Russian steel industry's use of self-fluxing sinter in the furnace burden.

Final paper of the session was presented by J. S. Breitenstein, vice president of the R-N Corporation, who discussed "Treatment of Mesabi Range Ores in the R-N plant." He cited some results obtained with Mesabi ore in the R-N pilot plant in Alabama. Through the use of a reducing atmosphere in a 9-foot by 150-foot rotary kiln, hot metal is turned out at a rate of 50 tons per day. The process

is largely dependent upon the prevailing price of scrap iron since the resultant kiln product replaces scrap iron in a steel furnace burden. One major advantage for the R-N process is the ability to produce a fairly constant analysis on the hot metal, whereas scrap irons are graded by their various alloy impurities, said Mr. Breitenstein. It seems quite feasible that the R-N process can be utilized effectively in restricted areas in the immediate future.

The AIME meeting was immediately followed by the 20th Annual University of Minnesota Mining Symposium. Theme of this two-day session was "Instrumentation and Controls in Mining and Beneficiation."

J. L. Riede, president of Ramsay Engineering Company in St. Paul, discussed "Types and Potentials of Instrumentation and Controls." He presented a general picture of what is presently being done in control work and the future outlook for control of mining and milling processes by instrumentation. Among the present developments are automatic starting relays, safety relays for moving equipment, and load control relays.

Nathaniel B. Nichols, vice president and chief engineer, Taylor Instrument Company, Rochester, New York, followed with a discussion of "Basic Control Functions." Mr. Nichols stated that the major problem in instrumentation and control is to place the control in a representative area; an area where time delay or process delay will not create undue lag in the resultant change made by activation of any control.

T. G. Fulmor, Testing Engineer, The Anaconda Company, Anaconda, Montana, discussed the operation of Anaconda flotation plants and the success of various automatic controls in these plants. He noted that process lag in a flotation process has been one of their major problems for successful instrumentation of the plant. Control of pH in the flotation circuit is being done by means of an automatic

titrator actuating acid or base circuits dependent upon the recording of the pH meter. When dealing with large pulp volumes, process dilution is always a problem, stated Mr. Fulmor.

C. M. Marquardt of Industrial Physics and Nucleonics Company in Salt Lake City, told of his company's experiences in instrumentation of various Western ore processing plants. One of the most notable was the firm's opportunity to completely instrument a uranium plant. The firm installed 48 units in the plant, selecting any control it felt had an even chance of economic feasibility. To date, 47 of these units are still in the plant, operating successfully.

"Shaft Furnace Control and Instrumentation" was the subject of a paper presented by William Dailey and Arthur Storm of Surface Combustion Company, Toledo, Ohio. They discussed the design of the shaft furnace with particular reference to their units in the pelletizing plant of Erie Mining Company at Hoyt Lakes, Minnesota. Shaft furnace instrumentation can best be applied as temperature controls in the various areas of the furnace, they said. Precise control of cold air introduced at the bottom of the furnace is a necessity for production of uniform, merchantable pellets. Continual control of gas passage throughout the furnace ore bed is essential. Degradation of pellets in the warming stage prior to the maximum heat zone creates bridges of material which stops the gas flow and puts the entire furnace under pressure.

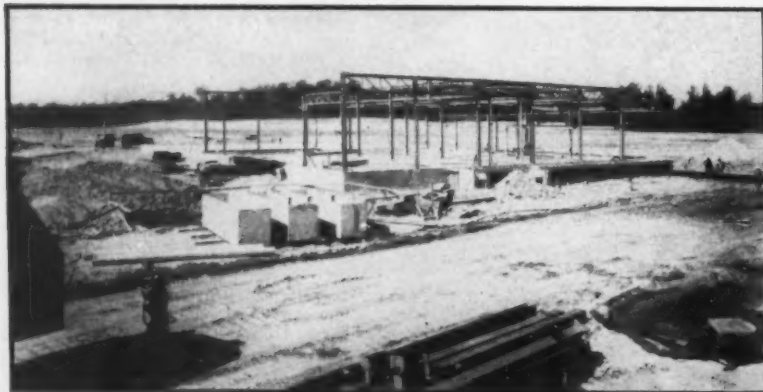
Two papers dealt with Instrumentation and Controls in Open Pit Mining and Underground Mining. Speakers for the first phase were E. S. Kuhlmeier, General Electric Company, Minneapolis, and Owen Thompson, Secode Corporation, San Francisco; Carl W. Anderson of the M. A. Hanna Company, Iron River, Michigan, spoke for the second phase. Each discussed the various controls applicable to mining methods with specific application to materials handling.

Prof. M. L. Stein, Director of the Numerical Analysis Center, Scientific Computing, University of Minnesota, discussed the use of "Digital Computers for Engineering Analysis." He outlined the use of digital computers to correlate and predict mining patterns, etc.

Final paper was presented by R. M. Moyle, Oliver Iron Mining Division, Duluth, who spoke on the "Application of Electric Computers to Mining Engineering Problems." Mr. Moyle cited Oliver Iron Mining Division's experience with computers as applied to the various mining properties. Various computers can be successfully applied to mining methods, according to Mr. Moyle. The success of their use so far has been from good to excellent, and they are finding more uses for computers yearly.

One of the highlights of the Symposium was a panel discussion by Paul Bingel, Development Engineer, Oliver Iron Mining Division; William Dailey; S. E. Erickson; T. G. Fulmor; A. S. Henderson; C. M. Marquardt; K. E. Merklin, Chief Metallurgist, Pickands Mather & Co.; Hibbing; Nathaniel B. Nichols; John Riede; and Arthur Storm. Moderator was D. W. Scott, General Manager, Continental Sales and Equipment Company, Hibbing, Minnesota.

The uses of controls and instrumentation as applied to the iron ore industry were discussed in detail, including the practicability of controls to regulate (1) crusher feed rates, (2) pulp levels in



Kennecott's New Refinery Under Construction

Ground has been cleared and preliminary construction has started on Kennecott Refining Corporation's new 16,500-ton-per-month electrolytic copper refinery which will be located near Baltimore, Maryland. The \$30,000,000 refinery is expected to be in operation later this year. The entire refinery is being engineered and constructed by The M. W. Kellogg Company from Kennecott's project design. It will be totally integrated, using the latest materials handling techniques and construction materials. The refinery will include equipment for casting wire bars, and a continuous copper billet casting operation.

sumps, (3) elevation of solids load in thickeners, and (4) recirculating loads in grinding circuits. A general conclusion from this panel discussion would be that the control manufacturer has a tremendous future ahead of him. Current developments and installations show that many difficult problems can be regulated by instrumentation. However, at the present time, at least in the iron ore industry of Minnesota and Michigan, considerably more development work will be required before complete instrumentation of mines and processing plants can be effected. With the necessity of more complex flow-sheets for the production of merchantable iron ore, the instrumentation and control manufacturer will play a more important role in achieving the required economics for these complex operations.



St. Joseph Lead Company is making good progress in development work at its Viburnum operation which covers parts of Crawford, Washington, and Iron Counties in Missouri. (The counties border each other.) Three shafts are to be sunk, and one has already been bottomed at 802 feet. Ore will average about 4.0 percent lead.

Copper Range Company of Boston, Massachusetts, parent company of White

Pine Copper Company which operates in northern Michigan, has offered to exchange mineral rights within the Michigan Porcupine Mountains State Park for state-owned rights outside the park. The offer was presented to the Michigan Department of Conservation, and is under consideration. Last year, Bear Creek Mining Company, Kennecott Copper Corporation's exploration subsidiary, applied for a lease in this state park. The application was withdrawn after a storm of controversy arose within the state.

The Minnesota Division of Lands and Minerals is preparing rules and regulations governing leasing of state lands for copper and nickel exploration. Involved are 13,000 acres in Cook County along the Gunflint Trail, 8,000 acres in Lake County, and 99,500 acres in northern St. Louis County. All are in northeastern Minnesota. The state is considering a minimum starting annual rental of \$1.00 an acre; this would increase to \$5.00 after four years, and to \$25.00 at the end of an additional five-year period. A Bear Creek Mining Company representative has suggested a 10¢ an acre starting price, with \$5.00 increases every five years thereafter. The state also plans to collect 20¢ per ton of crude ore after production is underway, plus 5 percent of the gross value in excess of \$12.00 per ton. Robert W. Bridgeman, the Bear Creek consultant, has recommended an \$8.00 rate.

Arkansas Representative Wilbur Mills of the Second District has introduced a bill in the 86th Congress which would provide for the extension of the government ore buying program for manganese

until 1964. The present program is set up to extend until 1961, but the quota is expected to be filled by October of this year.

Eagle-Picher Company's Mining and Smelting Division has acquired the mining equipment and facilities, along with most of the leases, of National Lead Company in the Baxter Springs area of southeastern Kansas. None of these properties are in operation. The mill, south of Baxter, will be dismantled and moved to National Lead property in southeast Missouri. The leases acquired by Eagle-Picher are known as the Ballard Mine group and cover several hundred acres south and west of Baxter Springs.



The Jones & Laughlin Steel Corporation's New York Ore Division has recalled about 100 employees for its Benson mine operation near Star Lake, New York. This will increase activity from 15 to 18 shifts per week; the division had been operating on 15 shifts for about a year. The recall order increases production from 70 to about 85 percent of full operation. Increased demand for ore at the corporation's blast furnaces at Cleveland, Ohio and Aliquippa, Pennsylvania has stimulated this action.

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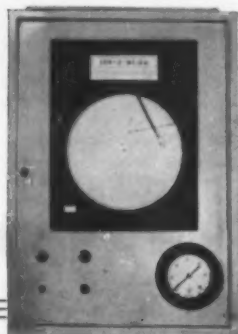
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CENTRAL AND EASTERN

New chairman of the House Subcommittee on Mines and Mining is Congressman Adam Clayton Powell of New York. Congressman J. Ernest Wharton, also of New York, will be minority chairman. The subcommittee has 17 voting members not including the chairman. Former chairman Congressman Walter Rogers of Texas will head the Subcommittee on Irrigation and Reclamation.

American Smelting and Refining Company has sold 225,973 shares of Cerro de Pasco Corporation common stock with a gross value of \$10,620,731. Asarco reportedly plans to use the money for investment in new projects.



Oliver Iron Mining Division of U.S. Steel Corporation is reported to be considering building a beneficiation plant for the Sherman Group of mines near Chisholm, Minnesota. The firm has already applied for use of the Three Mile Lake for tailing disposal. Approval was granted by the State Department of Conservation, provided construction is started on or before September 1, 1960. Three Mile Lake is 30 acres in size. Oliver owns the riparian rights. No objections was raised by the various representatives of the Izaak Walton League, Buhl-Kinney Sportsmen's Club, and United Steelworkers of America Union.

Erie Mining Company at Hoyt Lakes, Minnesota has announced that it plans to add two experimental pelletizing furnaces to its present 24 units. A construction contract had not been awarded at this writing, but construction is expected to start in early spring.

After a year of idleness, the Bennett mine of Pickands Mather & Co. is to be reopened. Production is scheduled for early spring and preparations for work are already under way.

M.A. Hanna Company is currently stripping the Robert mine on the Cuyuna Range in Minnesota, with first production scheduled for this year. On the Mesabi Range, stripping operations have started at several mines, mills are being readied for the increased activity during the ore season, and some construction is planned for later in the year. In the Michigan district, Hanna is continuing construction at the Groveland mine, and making plans to resume work at the Moose Mountain.

A new \$8,000,000 Great Lakes ore carrier will be completed this spring for Shenango Furnace Company. To be named "Shenango II", it will replace the "Shenango I" which was built in 1909. The new carrier is 710 feet overall and has a deadweight capacity of about 25,000 long tons. It will be assigned primarily to carry iron ore mined from the Snyder Mining Company properties in Minnesota to Conneaut, Cleveland, and Ash-tabula, Ohio. In 1958, Snyder shipped iron ore from three mines on the Mesabi Range: the Webb & Sellers Triangle open pit at Hibbing; the Godfrey underground mine at Chisholm; and the White-side open pit at Buhl. Total shipments were 545,428 gross tons. In 1957, these mines shipped 1,023,305 gross tons.

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INTERNATIONAL NEWS

Brazil, Peru Mines Get Export-Import Bank Loans

The Export-Import Bank in Washington, D.C. has made two recent grants to Latin American mining companies to aid them in current projects.

A \$12,500,000 credit to Cia. Vale do Rio Doce will assist the Brazilian firm in doubling its iron ore production. The company plans to increase its output capacity from 3,000,000 tons to 6,000,000 tons at its Itabira open-pit mine by improving its mine, railroad, and port facilities. The credit is to be guaranteed by either the national treasury or the Bank of Brazil, and is payable over 10 years beginning in 1962.

With the recent grant of a \$15,000,000 credit to Southern Peru Copper Corporation, the latter organization has raised its Export-Import bank loan to \$115,000,000 for development of the Toquepala copper deposit in Peru. Other capital has been provided by private sources, bringing total investment in the project to about \$245,000,000. The additional credit is to meet any unexpected overruns in total cost which could be brought about by inflationary prices, additional construction costs, or possible construction changes.

Union Miniere Opens New Congo Copper Mine

Copper production during 1958 at Union Miniere du Haut Katanga's mines in the Belgian Congo ran well above the total anticipated at the start of the year. Late in January 1959, the firm started work at a new open-pit mine at Lupoto in the Congo, and this will increase 1959 production still further. Over the next 12 years the Congo producer plans to spend about \$20,000,000 in new enterprises.

Union Miniere accounts for about 8 percent of the free world's copper output. A little over a year ago, the Belgian Congo producer announced that it would cut back 1958 copper production to 90 percent of the 1956 total, or about 222,000 metric tons. In October, however, production was increased with improvement in market conditions, and by the end of 1958 the company had produced 235,000 metric tons of copper, only 12,000 metric tons less than the all-time record output of 247,453 metric tons in 1956.

Indications now point to the fact that Union Miniere is now producing about 22,000 tons of copper per month from its Congo mines. This rate would put the level of copper output at a record high.

Minera Tamaya Expanding Chilean Mine Operations

Cia. Minera Tamaya S.A. reports that its \$5,000,000 development program in the Lago Buenos Aires district of Chile is rapidly nearing completion. Together with its subsidiary, Cia. Minera Aysen, the firm has been building smelters, roads, and a dam on the Chilean side of the lake.

Their copper property, called Las Chivas, is producing a 13 percent concentrate for direct export. The lower grade material goes to their plant at Puerto Sanchez where the company has a 70-ton smelter. The dam is being constructed to produce 1,000 kva for the Puerto Sanchez operations, and other

nearby projects, thereby decreasing power cost by about 20 to 1. One such project is the El Toro Mine which will be worked for copper, lead, and zinc.

At Puerto Cristales, the subsidiary Cia. Minera Aysen is operating a lead-zinc and silver property. A concentrator and smelter are located here. Production is about 500 tons of lead, zinc, and silver concentrates per month, and 330 tons of lead ingots. A new road is being built to open the area to the Pacific Ocean in order to ship without having to cross Argentina. The company owns three ships which bring in supplies and take out mineral products.

Tamaya also owns several properties in the northern zone of Chile. These are the Punataqui mercury, gold, and copper mines, and the mines Tamaya and Cerro Negro. Punataqui produces 12,000 kilograms of mercury monthly, and Tamaya and Cerro Negro each operate a 400-ton copper concentrator.

J&L Starts Development Of Lind-Greenway Mine

Jones & Laughlin Steel Corporation has started stripping and development operations on the Lind-Greenway mine, located on the extreme west end of the Mesabi Range. It will be operated as a part of J&L's Minnesota Ore Division, and is expected to produce about 700,000 gross tons of concentrates per year, or approximately 10 percent of J&L's blast furnace requirements.

Operation of the mine will be novel in that it will consist of two separate open pits, one on each side of Minnesota's

Prairie River. The pits are connected by a truck haulage bridge.

The crude ore will be mined by conventional power shovel methods, and hauled by heavy-duty trucks to a concentrator. It will then be washed or given a heavy media treatment prior to shipment. Initially, only the wash ore plant will be constructed, with heavy media units added as leaner ores are encountered.

Western Knapp Engineering Company has been awarded the contract to design and construct the concentration plant. Initial production is scheduled for April 1960.



NEW SOUTH WALES—A development and modernization program which The Electrolytic Refining and Smelting Company of Australia Pty. Ltd. started several years ago at its Port Kembla operation, continues unabated. At present, the company receives concentrate from Peko Mines, N.L. at Tennant Creek, and a number of other sources. Not all of Peko's output can be absorbed at present so that company, and other smaller producers, have been forced to sell some of their concentrates in Japan. The Port Kembla refinery, in addition to treating its own smelter's blister, has taken Mount Morgan's output and part of the Mount

U.S. Steel Builds Rail Link to Manganese Mine

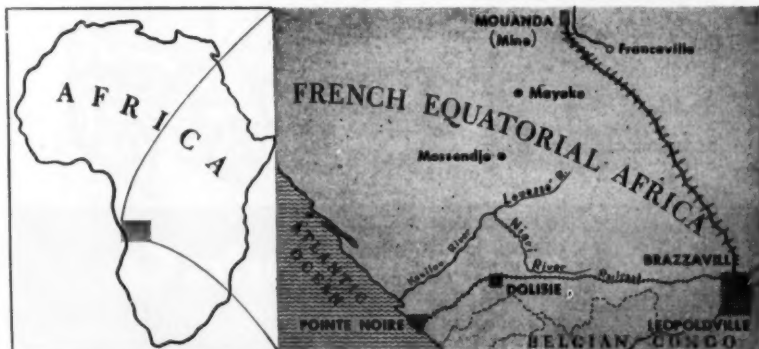
A new 200-mile-long railroad will be built in French Equatorial Africa to haul manganese ore to the Atlantic Ocean for shipment to United States steel mills. The mining company, Cie Miniere de l'Ogooué (COMILOG) has awarded the \$26,000,000 rail construction contract to the Utah Construction Company of San Francisco, California. Joining Utah in the contract are Compagnie Industrielle de Travaux de Paris, France, and Taylor Woodrow Construction, Ltd. of London, England.

The railroad will extend from the mine 200 miles south through the dense tropical jungle to Brazzaville (see map) which is already linked by rail with the shipping port of Pointe Noire. The new railroad will require moving of 10,000,000 cubic yards of dirt and rock for right of way,

two major bridges, and 30 smaller river crossings. Completion target is for 1962.

Mining of manganese will be relatively simple by open pits as prospect drilling has disclosed ore in a 36-square-mile area northwest of Franceville outlined on map. The generally flat lying tabular ore body is about 15 feet thick and is covered by only two to 15 feet of overburden. COMILOG has developed many millions of tons of 40 to 50 percent manganese ore at Mouanda.

United States Steel Corporation owns the controlling interest (49 percent) in COMILOG and will be the largest user of the ore. Also participating in ownership are the French Overseas Mining Office, 22 percent; Compagnie Minière de L'Oubangui Oriental, 14 percent; and Mokota El Hadid, 15 percent.



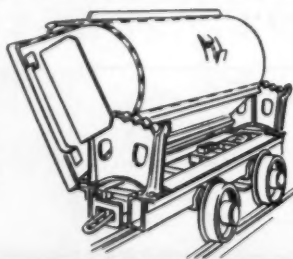
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Isa output. A Lurgi sintering plant and other equipment should be installed at Port Kembla about mid-year. The smelter will then be in a position to absorb additional material and produce more blister for the refinery to make up for the loss of Mount Isa copper. Considerable expenditure has been undertaken on the Port Kembla tankhouse and casting section during recent years and further projects are under way to expand these units. In addition to copper already referred to here, **Mount Lyell Mining and Railway Co. Ltd.**, at Queenstown, Tasmania, sends about three-quarters of its copper output to Port Kembla in cathode form for furnacing and casting. Thus, output of market shapes is nearly 40,000 tons per annum. (Gold refined is 60,000 to 80,000 ounces.)

REPUBLIC OF THE PHILIPPINES—Philex Mining Corporation has just completed construction of a second ore pass to ease the bottleneck in ore production. In December the firm treated 32,888 tons of disseminated copper-gold ore at its **Santo Tomas II** property, producing gold and copper valued at Pesos 330,106.18. Copper recovery was again low because of oxide in the ore.

TASMANIA—Electrolytic Zinc Company of Australasia at Risdon increased its zinc output by 10 percent in the six months ended December 17, compared with the same period of the previous year. Output was 53,400 tons. The company reports it had no difficulty in disposing of any of this. New contracts have been negotiated with mainland China and the Philippines.

NEW GUINEA—In the half-year ended November 30, 1958, **Bulolo Gold Dredging Ltd.** made a profit of \$(Canadian) 205,000, compared with \$(Canadian) 240,000 in the same period of the previous year. During this period of 1958, the firm dredged 2,784,700 cubic yards to recover 11,168 fine ounces of gold, compared with 3,075,400 cubic yards in the same period of 1957 for a return of 17,315 ounces gold.

REPUBLIC OF THE PHILIPPINES—Two ball mills have been installed, and the crushing plant about completed at the **Suyoc mine of Itogon-Suyoc Mines.** Production from the mine is expected shortly.

NEW SOUTH WALES—Production reports for last year reveal that **Consolidated Zinc Corporation Ltd.** and **New Broken Hill Consolidated Ltd.** mined less ore and produced less lead, silver, and zinc during the year. Actual output is as follows (with 1957 production in parenthesis): Zinc Corporation mined 659,268 tons of ore (762,912 tons) and produced 79,098 tons lead (90,820), 2,033,955 ounces silver (2,198,457), and 115,348 tons zinc concentrate (139,684). New Broken Hill mined 527,122 tons of ore (722,722) and produced 57,049 tons lead (64,794), 1,498,434 ounces silver (1,704,892), and 119,103 tons zinc concentrate (154,325).

REPUBLIC OF THE PHILIPPINES—For the first time, **Samar Mining Company** is selling its stocks in the United States. 200,000,000 shares of the company's capital stock are being offered. The firm's development program is moving ahead with construction of the road almost completed. The 38-kilometer road will connect the iron ore property in the upper Sibuguey River region in Zamboanga del Sur with a new ore loading pier in Pamintayan.

QUEENSLAND—By April 1959, Mt. Isa Mines expects to be treating 8,100 tons per day of lead-zinc and copper ores. Any increase beyond this is contingent upon expansion of the much-discussed Mt. Isa-Townsville Railway. The company continues to pay for Mine and Plant expansion from profits. Lower costs from increased production last year largely countered reduced prices for silver, lead, and copper. Even lower costs can be expected with further increases in production, according to G. R. Fisher, chairman of Mt. Isa.

FIJI ISLAND—Development work by Emperor Gold Mining Company Ltd. at Vatukoula has been concentrated upon the Eastern area off the internal shaft and has proved additions sufficient to cover the year's tonnage mined and add 105,000 tons to positive reserves. Total measured ore is now 800,000 tons at 8.7 dwts and 279,000 tons indicated at 8.3 dwts. The gold subsidy payable by the Fijian government of £F 2 per ounce for a period of three years, with a maximum of £150,000 per year, will benefit the company in its development program. For the year ended June 18, 1958, the company milled 180,888 tons with the average head value being 9.229 dwts. per ton.

NEW GUINEA—Australian Gold Development N.L., in testing an area under option at Kainantu, has "proved a large ore body carrying gold values sufficiently encouraging to warrant expedited and expanded developments." Present capital resources are not considered sufficient, and a new issue of shares is in prospect.



EUROPE

NORWAY—New electrolytic smelting furnaces have gone into operation at the Aardal II smelter of A/S Aardal og Sunddal Verk at Sunddalsora in western Norway. These are part of 132 units to be installed by the end of the year to increase output by 36,000 tons. Last year's production of aluminum ingot was about 71,000 tons, compared with 66,000 in 1957. Probable production this year will be about 100,000 tons. The new furnaces are being housed in two electrolytic halls, each 1,750 feet long, built since Aardal II was launched in 1956.

YUGOSLAVIA—Expansion of the mine workings and plant facilities at the Vares iron ore mine has been completed and production, which before World War II was about 180,000 tons annually, is now expected to reach 1,750,000 tons annually by the end of 1960. Accelerated development of this district began just after World War II and particularly after 1951. In the last seven years more than 22,000,000,000 dinars have been invested. Iron ore production reached 1,000,000 tons in 1956, increased to 1,200,000 tons by 1958, and is expected to reach 1,400,000 tons by the end of this year.

ITALY—Recently released figures show that mercury production during the first eight months of 1958 totalled 207,876 tons of ore, as compared with 237,788 tons in the same period of the previous year. Output of mercury metal during the eight-month period of 1958 totalled

1,461 tons, compared with 1,478 tons in the same period of 1957. There has been some talk in Italy about suspending the manufacturing tax and customs exit surcharge but, at this writing, there has been no action taken. Italian exports are presently handicapped by the high prices and cannot compete with foreign producers. A recent estimate placed unsold Italian mercury stocks at more than one year's production.

FRANCE—Pechiney, leading French aluminum producer, reported a 7,000-ton increase in production in 1958 over 1957. Output rose to 139,000 tons, and is expected to reach 142,000 tons in 1959. A new plant at Noguères in southwestern France which will use gas power supplied by the natural gas field at Lacq is responsible for the 1959 increase; in fact,

this plant is expected to enable Pechiney's output in 1961 to total 192,000 tons.

SWEDEN—During 1958 Statsgruvor A.B., owned by the government, completed centralization of its old shafts into one central shaft. The headframe is built, and the milling and ore dressing plants will be ready this year. The ore content at this mine runs about 35 percent Fe.

ENGLAND—The International Tin Council reports that Russia has agreed to limit her tin exports outside the Soviet countries in 1959 to about 13,500 tons. The USSR is not a member of the Tin Council, and accordingly not obliged to make any tin restrictions.

SPAIN—A rush for iron ore property is underway in Spain and many new



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claims are being staked every week, according to reports, even though there will be many transportation problems connected with any development work. 130 concessions were staked at Jubera, Soria, in northeast Spain, and other deposits are in nearby Cordovesin, Velfilla, and Beltejar.

SWEDEN—Luossavaara-Kiirunavaara A.B. at Malmberget has a new mineral dressing plant under construction. It includes milling and separating to obtain concentrated iron ore for pelletizing. A new pelletizing department is planned, and work on this will get underway in about one year. Production in the dressing plant is planned to start at the end of this year. In the first sections, the firm hopes to produce 600,000 tons of iron ore per year for the pelletizing plant. When all sections are completed, about 2,400,000 tons of ore for the pelletizing plant are expected annually.

U.S.S.R.—Figures released by the Central Statistical Board in the U.S.S.R. indicate that the Soviet Union produced 88,800,000 tons of iron ore in 1958—about 5 percent above the 1957 figure. United States production for last year is expected to total around 65,000,000 tons. Seven blast furnaces were built during the year, and four open hearth furnaces, two electric steel shops, a Bessemer converter, and several coke oven batteries were installed. Pig iron production totaled 39,600,000 tons, steel production 54,900,000 tons, and rolled metal production 42,900,000 tons.

EAST GERMANY—Production of sulphuric acid is to be expanded in East Germany under the new Seven-Year Plan. One new plant, built at a cost of between \$2,000,000 and \$3,000,000, is now going into production with an initial capacity of 60 tons per day. Around 1960, "the biggest plant in the world" is to start production near Dresden, producing 60,000 tons the first year and reaching an annual output of 220,000 tons in 1963. A third plant is to be built near Salzwedel which will reach an output of 40,000 tons in 1964. The total plan is to reach a production of 1,000,000 tons of sulphuric acid by 1970.

YUGOSLAVIA—The third 700-ton-per-day blast furnace has been blown in at Zenica in Bosnia, thus completing the big steel project built during the past 10 years. Zenica is now able to produce 700,000 tons of pig iron per year. Other iron blast furnaces are located at Sisak (Croatia), Jesenice and Store (Slovenia), and Vares and Ilijas (Bosnia). Production in 1957 of 714,271 tons is expected to be far overreached when 1958 totals are revealed.



MALAY—Gopeng Consolidated Ltd. and Kinta Mines Ltd. have agreed, subject to governmental consent, to acquire for £150,000 the mining undertaking of Societe Francaise des Mines d'Etain de Tekkah (known in Malaya as French Tekkah), one of the only two French companies operating in Malaya. The Tekkah company's ground lies adjacent to the Gopeng and Kinta properties, and this arrangement would give these com-

panies the benefits of valuable water and electric power supplies, some advantages of assessment under the International Tin Agreement, and also land for dumping purposes.

IRAN—The Seven-Year Plan Organization announces that operation of the **Esfandeq** chromite mine near Kirman has been placed under a joint company. Until now, it had been operated by the Plan Organization, assisted by a British company. The yearly output of this mine does not exceed 8,000 tons of chromite ore with 48 percent Cr_2O_3 and a Cr:Fe ratio of 3:1. Some quantities of lower quality are also mined.

CHINA—According to the "New China News Agency," Communist China now has iron ore reserves totaling 100,000,000,000 tons. At the beginning of 1958 this figure was placed at 18,000,000 tons, and increase is attributed to discoveries made by geological prospecting during the year. More than 600 iron ore deposits have been found and verified, according to the agency.

THAILAND—Progress has been made with the construction of **Tongkah Harbour Tin Dredging Ltd.**'s new sea dredge at Juru, near Penang. Originally it was planned to tow the completed dredge to Bhuket after the monsoon period so that it would be ready to go into operation around December 1959. Though it is impossible to forecast production quotas which may be in force at that time, the plant is considered essential from a long-term point of view in order to work available reserves in West Thailand.

BURMA—Matsuo Mining Company of Japan has decided to set up a joint venture company in Burma in order to develop an antimony mine there. Surveys conducted by Matsuo staff members have indicated that the mine is very promising. The mine is located near Moulmein, and electric prospecting has confirmed that the deposit exists 20 miles around the vicinity of Moulmein. Ore grade is about 40 percent. At present Japan imports almost all of its antimony requirements, or about 3,000 tons of 60 percent content annually.

TURKEY—Pig iron production increased in 1958 to about 245,000 tons from 215,481 tons in 1957. Present plans call for an output of 600,000 tons by 1960. Output of iron and steel products was said to be 158,959 tons in 1957 and about 161,000 tons in 1958. The 1960 goal is 500,000 tons.

NEPAL—Dr. J. J. O'Rourke, head of the **United States Mission** in Nepal, completed the first geological survey of this Himalayan kingdom after six years' work. Copper, cobalt, mica, and some iron ore have been found.

MALAYA—A French company, **Societe des Etaines de Kinta**, has reportedly applied for a 75-acre concession of rich tin land 24 miles south of Ipoh. This area, which runs along a two-mile stretch of railway main line at Kampar, is expected to yield to the government an estimated £1,870,000 from export duty and income tax. If the grant is made, the railway line will be diverted and a new Kampar station will be built.

IRAN—A contract has been signed between the **Seven Year Plan Organization** and the **Allen Company** of the United States for an economic survey of the Kirman Province. Reports will be submitted in two years. The survey will bear on mineral deposits and potential energy reserves.

SOUTH KOREA—The **Tong-A Metal Refining Company** has completed its Bismuth refinery in Yondongpo and it is now in production. Capacity is 25 tons of metallic bismuth (99.5 percent) monthly. Ore will come from the **Chongkak** mine and others in the area.

INDIA—The Government of India has set up a private corporation with an authorized capital of Rupees 15 crore, to develop all minerals except coal, gas, and oil. A board of directors consisting of officials and nonofficials has also been appointed. Because most of the minerals to be mined, such as copper, sulphur, zinc, lead, and chrome, have strategic significance, the corporation will be run as a public sector venture, though help from private investors in some of the subsidiaries to be established, will not be excluded. The cabinet minister in charge, K.D. Malaviya, has been assured that organization of this firm will not shut the door completely to private enterprise in this field, but the reactions by the State governments in disposal of applications for prospecting and mining leases reportedly are already being felt by the private sector. The general public feeling is said to be that this new enterprise might also follow in the wake of the utter failure of the **State Trading Corporation** in handling of ore exports.

PAKISTAN—Large deposits of fluor-spar are reported in Chitral near Mirgasht and Yarkhan, Gilgit and Hunza, South Waziristan, Sherwan in Hazara district, and Kohi Maaran range in Kalat state.

MALAYA—Two of **Malayan Tin Dredging Ltd.**'s five dredges have been closed down as a result of output restrictions, these dredges are being maintained in a state of readiness and can be brought into action at short notice. At the **Kamong Gaha** section, work on the construction of a new dredge should be completed by early July. A claim to an allotment

for an additional tin quota for this dredge has been recognized by the authorities, but no decision regarding the amount has been announced so far.

CHINA—A large lead-zinc operation is to be undertaken in Huansi province with the aid of Bulgarian equipment, according to reports from behind the "bamboo curtain." This will include a 400-ton-per-day flotation plant, an open pit and two underground mines, townsite, surface buildings, and ore dressing plant. In Liaonin province of northeast China, another large flotation and ore dressing plant will be built which will have a daily capacity of 1,000 tons of lead and zinc ore. All equipment for both plants will be manufactured in Bulgaria.



AFRICA

FEDERATION OF RHODESIA & NYASALAND—**M.T.D. Mangula Ltd.**, currently developing copper deposits in the Sinoia area of Southern Rhodesia, expects to complete the installation of its second **Aerofall** mill unit in the first quarter of this year. Operations will then be expanded to full capacity production. Each of the two units is expected to give an output of 1,750 tons of dry pulp a day, at 70 percent minus-200-mesh. In the first half of this year, about 26,000 tons of concentrates are expected to be produced for refining overseas. In the year ended September 30, 1958, with one **Aerofall** unit in operation, 10,700 tons of concentrates were produced with an average copper content of 51.96 percent.

UNION OF SOUTH AFRICA—**Winkelhaak Mines Ltd.**, now officially in



United Nations Trains Burma's Mining Engineers

United Nations mining instructors van den Berge (center right) and McFarland (center left) are shown above, together with 15 third-year Burma Government Technical Institute students of Mine Technology. The picture was taken during a field trip to the Kanbank mine, an alluvial tungsten producer located about 50 miles north of Tavoy. This is the second class to study mining. The first class graduated in March 1958, and most are employed at the famous Bawdwin silver-lead-zinc mine now operated as a joint venture of Burma Mines Ltd. and the Burma government.



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GAS-COOLED TYPE—Solids are cooled by direct contact with cooling air (atmospheric, or dried and refrigerated). Inert gases may be used in a closed system.

WATER-COOLED SHELL—Water is externally applied to the shell, either by sprays or by partially submerging the shell.

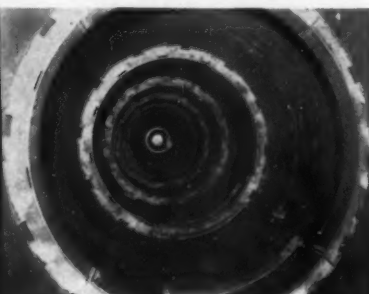
TUBULAR TYPE—Internal water-cooling tubes are assembled with the rotating shell, or installed as a stationary bank of tubes concentric with the shell. Alternately, the water leaving either of these tube sections may be used for supplemental spray cooling on the shell exterior.

DIRECT-CONTACT WATER—For rapid cooling from very high temperatures, water is sprayed directly on the hot material to utilize the latent heat of vaporization. Usually supplemented by secondary air cooling.

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INTERNATIONAL

gold production, reported ore reserves at December 31, 1958 of 1,200,000 tons, averaging 5.7 dwt over 58 inches or 330.6 inch-dwts. By the same date, 32,485 feet of Kimberley Reef had been sampled, with 21,108 feet or 64.9 percent payable averaging 6.5 dwt over 58 inches or 378 inch-dwts. Drilling results in and close to the lease area indicate a grade range of 4.8 to 5.7 dwt over 58 inches or 280 to 330 inch-dwts with payability of 55 percent to 70 percent. In the first month of production, December, 69,000 tons were milled with a yield of 4.492 dwt, which should improve as the proportion of development rock in the mill feed declines. The ore reserve width, if maintained, suggests a high-tonnage mine, calling for a high milling rate.

BECHUANALAND—Rhodesian Selection Trust Ltd. is negotiating for mineral concessions in the territory, mainly for copper and possibly coal.

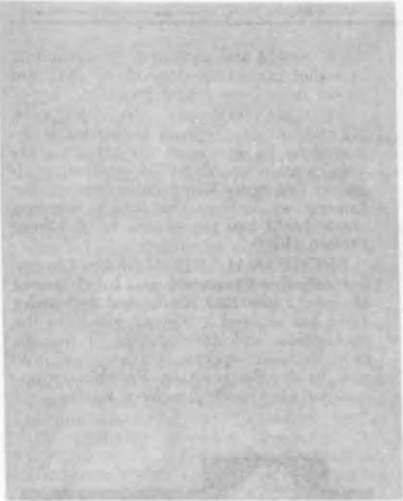
SOUTH WEST AFRICA—South African Minerals Corporation, which shipped 106,000 tons of manganese ore in the 1957-1958 year, expects shipments in the current year to be only about half of this tonnage. Profit margins have been seriously reduced by substantially higher costs and the decline in manganese ore prices. Production operations were suspended some months ago, and the company has been confining operations to development and prospecting. Production facilities thus have been placed on a better footing. Sales in the current year should cover costs of the current program of development and prospecting, and costs should now be reduced slightly.

MOROCCO—A group representing United States steel firms, such as **Republic Steel Corporation** and **National Steel Company**, is said to be considering establishing a steel industry in Morocco. The \$20,000,000 project would use iron ore mined near the port of Nador in the former Spanish zone and Moroccan coal. A sample 5,000-ton ore shipment is to be tested in the United States.

UNION OF SOUTH AFRICA—The two haulages being driven from the Virginia mine into the leased area of **Merriespruit Orange Free State Gold Mining Company Ltd.** have been advanced sufficiently far to permit development toward the Basal Reef horizon in the near future. From one of the haulages, 22 boreholes have intersected the Basal Reef, 14 disclosing payable values averaging 375 inch-dwts. and 19 inch-pound of U_3O_8 over a channel width of 44 inches. Boreholes drilled from the surface indicated an average grade range for the lease area of 220 to 340 inch-dwts., with payability of 55 percent to 65 percent.

FEDERATION OF RHODESIA & NYASALAND—Rhokana Corporation Ltd., following tests of rod-mills, has decided to employ these units as a reduction stage between crushing and fine grinding in the mills to eliminate the tertiary crushers and screening plant and to effect considerable labor-saving. Relevant ball-mills are being converted to rod-mills. Modifications and improvements in the reverberatory furnace circuits, especially in charging and firing, have resulted in expanded output from the same number of units. Extensive use is now being made of the cage-method of raising, particularly in pilot raises for new shafts.

BELGIAN CONGO—Societe Miniere du Beceka's mechanization program in



This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

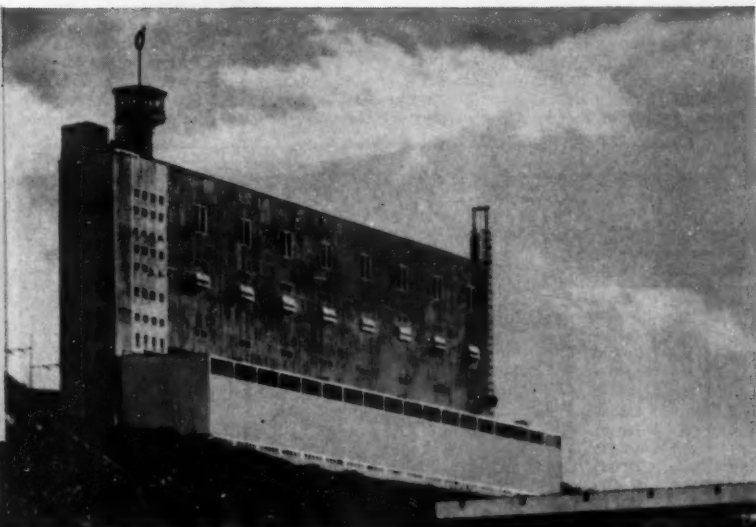
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the Bakwanga fields which was started in 1953, will be completed during the first quarter of this year when the first section of the central plant for clearing and concentration of diamond holding gravel will be put into operation. Production has risen steadily in the past 10 years, from 5,300,000 carats in 1948 to an estimated 16,000,000 in 1958.

GHANA—An African contractor has been granted a lease on a rental and royalty basis to operate in a 3-square-mile diamondiferous area on properties of **Offin River Estates Ltd.** Mining is now in progress.

FEDERATION OF RHODESIA & NYASALAND—One of the major chromite producers in Southern Rhodesia, **Mapanzui Chrome Mines Pty. Ltd.**, has extended its holdings through the acquisition of additional chromite mining rights in the Belingwe Reserve to the south of Shabani.

SIERRA LEONE—Illicit diamond mining, which in the past has damaged the outlying areas, is now being directed at the rich reserves of **Sierra Leone Selection Trust Ltd.** on an organized mass scale. This is likely to affect the company's raw material for the next two or three years, and, if it is allowed to continue for another six months, company officials believe the continued existence of the company would be in danger; illicit mining would then have taken so much of the best that what remained would not be worth mining. The area in Kono Province has particularly been affected. As many as 20,000 men who do not belong to the district have invaded the area. Arrests in the past few months

have included more than 500 accused of illegal mining and over 2,000 were found in the area without permits.

FRENCH WEST AFRICA—A new company has been formed—**Compagnie Holding Pour l'Aluminium Africain**—as a holding company which will finance the aluminum mining and refining projects planned for French Africa by **Pechiney** and **Ugine**. These two large French aluminum producers have joined with the **Cofimer** investment trust to create the firm. It has a founding capital of 1,000,000,000 French Francs.

FEDERATION OF RHODESIA & NYASALAND—The **Chambe** gold mine in the Lusaka district of Northern Rhodesia will be reopened.

UNION OF SOUTH AFRICA—**Free State Saaiplaas Gold Mining Company Ltd.** has completed sinking its No. 1 shaft to its final depth of 5,835 feet in the Orange Free State. No. 2 shaft has almost been finished, and work is underway on erection of the reduction plant. No reef development has been accomplished yet.

MADAGASCAR—The President of the Republique Madagascar, M. Philibert Tsiranana, has been touring West Germany and in several speeches before the **German African Gesellschaft** and the **Chambers of Industry and Commerce** in Cologne has tried to interest German industrial circles in Madagascar development and mining. In the name of his government the President declared that Madagascar would never take discriminatory measures against foreign property. He said also that production of graphite,

mica, quartz and monazite is expanding, and that important deposits of coal and nickel have been found recently.

FEDERATION OF RHODESIA & NYASALAND—**Gypsum Industries** is reported to have opened up a high-grade vein containing 52 to 54 percent manganese ore in its **Kampumba** mine in the Lunsemfwa Valley. The firm is shipping about 1,000 tons per month by rail from Broken Hill.

BECHUANALAND—**Marlime Chrysotile Asbestos Corporation**, a subsidiary of **Marble, Lime and Associated Industries Ltd.**, has secured a 20-year grant for the exploration and development of manganese deposits over a 9,000-square mile area in the Protectorate. Preliminary operations are reported to have started.



BRAZIL—**Companhia Siderurgica Paulista (Cosipa)** of Sao Paulo has awarded a \$170,000,000 contract to the heavy construction division of the **Henry J. Kaiser Company** in the United States for construction of a steel plant at **Piacaguera**. The project includes coal handling facilities; 25 miles of railroad track within the 1,200-acre site; iron ore and limestone crushing and screening facilities; 53 coke ovens; a blast furnace; soaking pits; an L-D processing plant consisting of two 60-ton furnaces; slab and plate mills; a 66-inch hot strip mill and continuous pickling line; galvanizing equipment and a cold reducing mill. Also included is an oxygen producing plant, and a 30,000-kw steam power plant. The integrated steel plant is to have an initial annual capacity of 300,000 metric tons of rolled steel products.

PERU—Several mining companies are undertaking development work on various Peruvian deposits. **Cia. Minera Condor S.A.** is about to develop its **Taurimarc** copper mine in the Huanaco district, **Pisco**. **Cia. Minera Palca S.A.** will start work on the lead-silver mine in **Vila Vila** district of **Lamp, Puno**, while another lead-silver mine at **Parac, San Mateo**, is being developed by **Negociacion Minera y Metalurgica Proano S.A. Cerro Morritos (Tacna)**. **Iron Mining Company** plans to begin development of some high-grade iron ore veins only six miles from the sea coast.

CHILE—**Cia. Minera Santa Barbara** plans to build a 50,000,000 peso mechanical ore dock for the port of **Taltal** in the province of **Antofagasta**. Negotiations have been started with the government to obtain the necessary public lands along the bay front to build the installations. No statement has been given about the capacity but it is expected that the installation will be similar to that at **Huasco** which loads ore from the company's mines at **Vallinar**.

URUGUAY—Two West German geologists are now in Uruguay to survey manganese deposits for the government. After their reports are available, German firms are expected to take part in developing the ore.

DOMINICAN REPUBLIC—Regular shipments of bauxite to the **Aluminum Company of America's** new alumina re-

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AB	54"	1080 lb.
3B	36"	1400 lb.
3B	42"	1540 lb.
3B	48"	1730 lb.
3C	60"	2590 lb.
3D	48"	2030 lb.
3D	60"	2865 lb.
3D	72"	3700 lb.
3D	84"	4000 lb.



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fining plant at Point Comfort, Texas are getting underway. The first shipment was made in January when a 7,300-ton load was delivered aboard the ore carrier "Dispatcher", marking the first time in history bauxite had been exported from the Dominican Republic, according to Alcoa officials. The ore is mined at Aceitillar, 21 miles inland, and trucked to the new ore loading station at Cabo Rajo built by Alcoa on the southwest coast. These shipments culminate several years of exploration and development work by Alcoa Exploration Republic at an initial cost of \$14,000,000.

COLOMBIA—Exploration work by South American Gold & Platinum Company has disclosed two promising underground mining prospects, but the company has not decided whether present mining conditions in Colombia justify the equipping of these properties. According to the company's management, conditions under which mining companies must operate in Colombia "have taken a serious turn for the worse since June 1957". Though the country has many pressing economic problems of its own to solve, government decrees restricting gold and platinum exports, and levying of additional taxes have severely handicapped mining companies in opening up new new properties.

MEXICO—A new system of export quotas has been set up by the Mexican government to conform to the quotas established by the United States. According to Mexican sources, American Smelting and Refining Company has been assigned a 5,000-ton lead quota for each of these two groups: Compania Minera de Penoles, Metalurgica de Penoles, and San Francisco Mines of Mexico Ltd; American Smelting and Refining Company and its affiliated Cia. Minera Asarco. For zinc, export of 7,508 tons reportedly is authorized for Asarco, Cia. Minera Asarco and Cia. Metalurgica Asarco, with other companies shipping smaller amounts.

BOLIVIA—South American Placers, Inc., wholly owned subsidiary of South American Gold & Platinum Company, is well along with its program to equip its Bolivian property with one dredge. All of the major equipment has now arrived in Bolivia and has been transported to the company's airfield at Caranavi where it is being flown by the firm's aircraft to the dredge construction site at Teoponte. Recent exploration drilling has indicated additional and substantial gravel reserves, so it now seems likely that a second dredge will be arranged for after the first dredge has operated profitably in the new placer area.

CHILE—The El Salvador mine of Andes Copper Mining Company is scheduled to go into production in April at about 50 percent of its production capacity. Eventual goal is 80,000 to 100,000 tons per year. The Potrerillos mine has been producing less than 3,000 tons of copper per month, and this mine may be shut down when the El Salvador is brought into operation.

COLOMBIA—As of January 30, 1959, Asnazu Gold Dredging Ltd. wound up its operations and went into voluntary liquidation. For many years, the firm had operated dredges on the Cauca River, some 25 miles south of Cali.

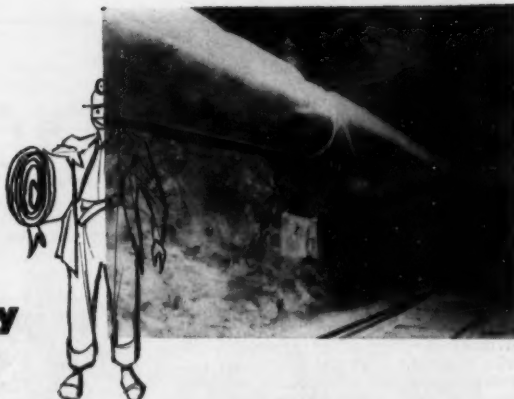
JAMAICA—International Metals Ltd. has completed a one-year program of exploration for copper and iron in St. Andrews Parish, Jamaica. The company

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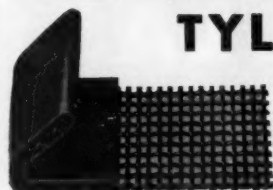
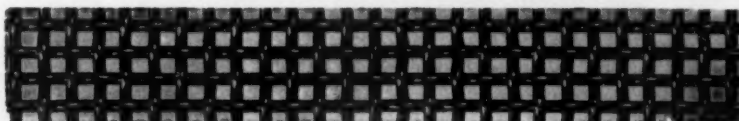
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holds prospecting permits and a mining lease on approximately 7,000 acres of land 12 to 15 miles east of Kingston, having acquired the rights through purchase of Mavis Bank Iron Ore Ltd. An evaluation of copper and iron deposits occurring on the concessions is being conducted by the firm of Chapman, Wood, and Griswold, mining consultants of Albuquerque, New Mexico.

PERU—Numerous exploration projects are reported underway throughout the country. The Buenaventura Mining Company is examining a large lead-silver mineralized zone in the district of Paras, province of Cangallo, Ayacucho. In Yerba Blanca, Sechura, Jorge Alberto Mining Company is exploring a large phosphate zone, while Santa Rosa Mining & Agricultural Company is exploring a copper mineralized zone near the Huahuano farm in the province of Melgar, Puno. Cerro de Pasco Corporation is exploring a mineralized area of lead-silver veins in the Zancudo Canyon, Yauyos.

ARGENTINA—The national government has authorized the export of borax, subject to certain conditions. This will no doubt intensify the exploration work being done by various groups in Puna de Atacama, Salta Province.

PERU—The Peruvian Atomic Energy Commission reports the discovery of uraninite at Vilcabamba in the province of La Convencion, Cuzco. The discovery is still being explored and it has not yet been determined whether the deposit has any commercial value.

CHILE—Compania Minera Sierra Gorda has closed down its operation at Sierra Gorda because of dangerous min-

ing conditions underground. No plans are being made for reopening the mine.

MEXICO—M. W. Kellogg Company, world-wide licensing agent for the HyL sponge iron process, has been awarded a contract by Fierro Esponja in Monterrey to engineer and construct a second plant for the firm. The new plant will have a capacity of 500 tons per day; the present plant produces 200 long tons of sponge iron per day.



NORTH AMERICA

NORTHWEST TERRITORIES—North Rankin Nickel Mines Ltd. has joined with several other firms in forming a syndicate which will undertake exploration on the west coast of Hudson Bay. North Rankin's property at Rankin Inlet, some 320 miles north of Churchill, Manitoba, will serve as base of operations for the exploration work. North Rankin will not contribute any money to the venture; instead, its new airplane will be placed at the group's disposal, and the firm will furnish four field parties. North Rankin produced slightly more than 5,400,000 pounds of nickel and 1,200,000 pounds of copper during the 1958 season, marking its first full year of production. The company is also drilling to the east and west of its ore body and results have been encouraging. Surface and underground drilling will continue.

ONTARIO—Improved market conditions have led Lowphos Ore Ltd. to decide to reopen its Moose Mountain iron mine, located about 35 miles north of Sudbury. Production should be underway by April 1, at a rate of 550,000 tons of concentrate annually. A new plant was built last year but was never opened because of a low demand for iron ore at that time. The concentrates will be shipped to a new dock at Parry Sound about 140 miles away.

BRITISH COLUMBIA—Howe Sound Company is reopening its big Britannia Beach copper mine which was closed in March 1958, because of lower copper prices. Production is to be resumed as soon as machinery can be reinstalled in the mine. Management is planning to employ about 350 men in a streamlined operation which will turn out the same 1,200-ton daily production as before the shutdown. A. G. Kirkland, Salt Lake City, Utah is company general manager.

QUEBEC—A preliminary ore estimate has been sufficiently encouraging to warrant immediate underground development by New Hosco Mines Ltd. A total of 1,600,000 tons averaging 2.53 percent Cu, plus another possible 168,800 tons of 2.17 percent Cu, and about 716,000 tons averaging 8.23 percent zinc was the estimate. The consulting geologist now recommends that plans should be prepared for both underground exploration and underground development of the main part of the ore body along a specified 600-foot length.

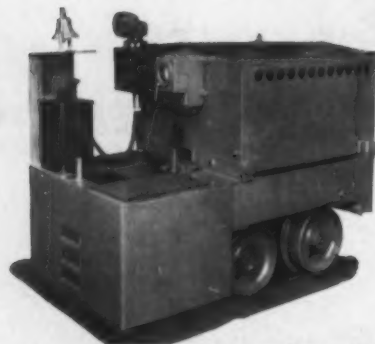
ONTARIO—Production at International Nickel Company of Canada's mines and plants is being increased to about 33 percent over the rate at the time the three-month strike was called late last year. The increase is believed necessary to restore customer inventories and Inco's own stocks. The Murray mine, one of the five underground mines in the Sudbury district, is going back into production after being closed in July 1958.

NEWFOUNDLAND—Canadian Javelin Ltd. has changed its name to Javelin Corporation and will become a United States company with headquarters in New York City. Main reason for this action is reported to be the fact that the majority of stockholders are Americans. The company's headquarters until now had been in St. John's, Newfoundland. Its Wabush Lake iron ore properties in Labrador have been proven to contain in excess of 2,500,000,000 tons of low-grade iron ore. Pickands Mather & Co., together with Youngstown Sheet and Tube, Interlaken Iron Company, and The Steel Company of Canada Ltd., has leased the deposit and is undertaking construction of 42-mile railroad to the deposits.

BRITISH COLUMBIA—A promising strike of silver-lead ore has been made by J. Murison of Edmonton and an associate, J. Hunt, on a 20-claim property between the Yale Lead and Zinc and Western Mines properties in the Ainsworth mining division.

ONTARIO—Northspan Uranium Mines has suspended production from its Spanish American mine and concentrator "in an effort to balance the company's output with allowable deliveries." The plant is to be placed on a care-and-maintenance basis at a cost of \$400,000; cost of monthly maintenance is expected to run between \$5,000 and \$10,000. Underground equipment is being removed. The firm's two other uranium plants—the Lacnor producing 4,000 tons per day,

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and the Panel at 3,000 tons per day—will maintain output at the rate of 400,000 pounds per month, which is the rate permitted until July 1.

BRITISH COLUMBIA—The Telegraph Creek area of western British Columbia, about 50 miles east of the Alaskan Panhandle, is attracting the attention of several large mining companies. This interest is based on recent information released by the Geological Survey of Canada which indicated the presence of asbestos in the Dease Lake area, and molybdenite about 40 miles south and west of that lake. Cassiar Asbestos Corporation immediately sent crews to the area to stake claims. They were followed by Phelps Dodge Corporation of Canada. Kennecott Copper Corporation, through

its subsidiary, Northwestern Explorations, moved into the molybdenite-bearing region to stake its claims.

QUEBEC—A Montreal import-export firm, Lewis, Keefe and Penfield Ltd., recently shipped 20,000 tons of automotive sheet steel to Russia, and purchased 80,000 tons of manganese and chrome ores from Russia. The sheet steel came from Republic Steel Corporation in the United States. The manganese and chrome ore will be sold to United States and Canadian steel makers, according to reports. Last year, the firm purchased manganese and chrome ores from China, and sold 1,000 tons of copper rod.

YUKON TERRITORY—Silver Standard Mines plans to undertake a \$40,000

exploration program on its recently acquired gold property near Carmacks. An electromagnetic survey will be made of the favorable zone.

QUEBEC—Shaft sinking is underway on a placer property in the Eastern Townships of Quebec by Beauce Placer Mining Company. The latter was formed by M. J. Boylen Engineering Company and New York-Alaska Gold Dredging Corporation. The shaft will be used to examine the formation of the ground in order to design suitable buckets for dredges.

BRITISH COLUMBIA—The McPhail Engineering Company plant at Spillimacheen, which was destroyed by fire last December, is to be rebuilt as soon as possible. When completed, Giant Mascot Mines will resume shipments of barite to the plant.

ONTARIO—Rio Tinto Mining Company of Canada Ltd. has exercised its right to purchase 592,150 shares of Algom Uranium Mines Ltd.

NEW BRUNSWICK—The Geological Survey of Canada has reported the presence of a barite deposit a few miles northeast of Woodstock. According to the Survey, the barite does not outcrop and its extent is not known, but it occurs in a topographical depression about 20 feet deep, 500 feet wide, continuing southeasterly for about a mile. Moneta Porcupine Mines and Dome Mines have staked 57 claims on the barite occurrences on a 50-50 basis. Moneta splits its share as follows: 70 percent to Moneta and 30 percent to Buffalo Ankerite Gold Mines.

QUEBEC—Trans-Canada Explorations has purchased 450 claims in the Mount Wright iron area from S. B. Roman, after preliminary aerial magnetometer surveys had indicated several anomalous areas of high magnetic intensity. The claims are located within three miles of the east end of Quebec Cartier Mining Company's property, and one group completely surrounds a group held by Canadian Javelin.

MANITOBA—Rash-Mac Exploration is conducting limited diamond drilling on a 27-claim gold prospect near Payuk and Twin Lakes, about 20 miles southeast of Flin Flon where encouraging results are being obtained. The company changed its name late last fall from Ken-Rio Copper Mines.

QUEBEC—Algom Uranium Mines is deepening its shafts at its Quirke and Nordic properties to open up new levels for development but will not interfere with regular operations. The Nordic shaft will be deepened by 435 feet to 1,325 feet, allowing for four new levels; the Quirke will go 300 feet deeper to 1,164 feet, opening up three new levels, and bringing the total to nine.

BRITISH COLUMBIA—Estimated ore reserves at the Craigmont Mines, Merritt property have increased slightly. Drilling has now indicated 14,710,000 tons of probable ore with an average grade of 1.82 percent copper and 17.3 percent iron, and an additional 9,000,000 tons of undetermined grade classified as possible ore. The property is under option to Noranda Mines, Canadian Exploration, and Peerless Oil and Gas. Further development during the first quarter of this year will help to assess the actual character and grade of the ore body, and by mid-year it is expected that underground diamond drilling will indicate to what extent mineralization can be projected below the 3,000-foot elevation.

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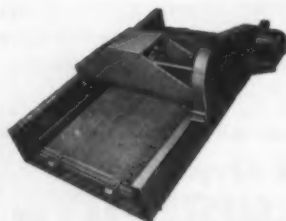
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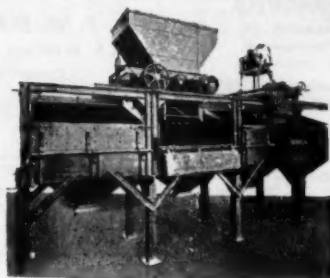
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- 4-Ingersoll-Rand Model ASMNOH
- 4-Joy Model FF211
- 1-Ingersoll-Rand Model HNN-1J

LOADERS

- 17-Elmco 12B, 18" ga.
- 8-Elmco 21, 18" & 24" ga.
- 3-Gardner-Denver Model 9, 18" ga.
- 1-Joy HL3, 18" ga.
- 1-Joy HL20, 24" ga.

APRON FEEDERS

- 1-24" x 20' Link-Belt
- 1-42" x 18' Stephens-Adamson

DRILLING EQUIPMENT

- 14-Ingersoll-Rand Model R48 Stoppers
- 20-Ingersoll-Rand Model JH38A Jack Drills
- 7-Gardner-Denver Model FL48-4 Air Leg Drills
- 3-Tor Model 990 Air Leg Drills
- 6-Atlas Copco Model BBL22 Jack Drills
- 6-Ingersoll-Rand Model DA35 Drifters

GRATORY CRUSHERS

- 1-2' Symons Cone
- 1-12' Traylor Type T
- 1-2' 4' Traylor Type TY
- 1-3' Traylor Type TY

PUMPS—SAND

- 3-1" Denver
- 1-1 1/2" Kimball-Krogh
- 1-1 1/2" Vacseal
- 2-Denver
- 2-A.S.H. Hydrosal
- 1-2" Vacseal
- 4-2" Willley
- 1-3" A.S.H. Hydrosal
- 2-3" Willley
- 2-4" A.S.H. Hydrosal
- 1-4" Willley
- 1-6" Amco

SCREENS

- 1-3' x 6' Symons Single Deck
- 1-3' x 6' Robins Gyrex
- 1-4' x 10' Allis-Chalmers Double Deck

TANKS

- 4-8' x 11 1/2' Acid Storage Tanks
- 1-25,000-gal. Steel Tank

BALL AND ROD MILLS

- 1-4' x 4' Marcy Ball Mill
- 1-6' x 4' Hardinge Conical Ball Mill
- 1-6' x 6' Allis-Chalmers Ball Mill
- 1-7' x 5' Allis-Chalmers Ball Mill
- 1-8' x 22' Hardinge Conical Ball Mill
- 1-3' x 8' Morse New Rod Mill
- 1-4' x 10' Hardinge Rod Mill
- 2-5' x 10' Traylor Rod Mills

JAW CRUSHERS

- 6-2 1/4' x 3 1/2' New Morse Lab Crushers
- 6-4' x 6' New Morse Lab Crushers
- 1-6 1/2' x 7' Handy Jaw Crusher
- 1-8' x 15" Wheeling Jaw Crusher
- 1-9' x 16" Day Jaw Crusher
- 1-9' x 16" Universal Jaw Crusher
- 1-10' x 16" Universal Jaw Crusher
- 1-12' x 24" Universal Jaw Crusher
- 1-8' x 36" Cedar Rapids Jaw Crusher
- 1-42" x 48" Traylor Jaw Crusher

CONCENTRATING TABLES

- 10-Deister Diagonal Deck Right Hand
- 10-Deister Diagonal Deck Left Hand
- 5-Deister Overstrom Diagonal Deck Left Hand

LOCOMOTIVES

- 6-1 1/2 Ton Mancha "Tammars"
- 1-1 1/2 Ton General Electric Battery Locomotive
- 3-3 1/2 Ton Mancha "Titan A" Battery Locomotives
- 1-4 Ton Westinghouse Battery Locomotive
- 1-4 Ton General Electric Trolley Locomotive
- 1-6 Ton Goodman Trolley Locomotive
- 1-6 Ton Jeffrey Trolley Locomotive
- 2-6 Ton General Electric Battery Locomotives
- 2-7 Ton General Electric Battery Locomotives
- 1-7 Ton Jeffrey Trolley Locomotive
- 1-7 Ton Atlas Battery Locomotive
- 2-8 Ton Goodman Battery Locomotives
- 2-8 Ton General Electric Battery Locomotives
- 3-8 Ton Ironton Battery Locomotives
- 1-8 Ton Whitcomb Battery Locomotive
- 4-10 Ton Atlas Battery Locomotives
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- 1-13 Ton Jeffrey Trolley Locomotive
- 1-13 Ton Goodman Trolley Locomotive
- 1-15 Ton Jeffrey Trolley Locomotive

FOR SALE

- 1-CP-No. 5 Diamond Core Drill
 - 1-CP-No. 3 Air Hoist
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 - 1-Safety Collar
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- 1-400 HP Flory Double Drum Mine Hoist
- 72"x48" Drums
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- 1—36" X 48" Birdsboro Buchanan
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- 1—15" X 24" Cedar Rapids Crushing Plant

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- 1—6' X 6' Oliver, Stainless Steel, complete

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- 2 cell, 48" X 48" Agitair, 15 HP
- 2 cell, 36" X 36" Fagergren, Level Type
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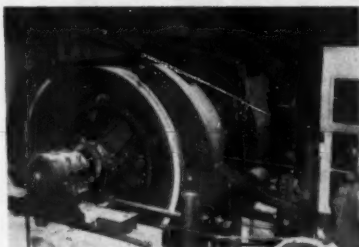
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- 1—26" X 24" Dings Magnetic Head Pulley

Mills, Ball & Rod

- 14—8 X 6 Marcy Type Ball Mills
- 6—6 X 12 Allis Chalmers Ball Tube Mills
- 2—6 X 9 Allis Chalmers Ball Mills
- 1—5 X 8 Traylor Rod Mill, 150 HP, 440 V
- 5—8 X 9 Traylor Ball Mill, 250 HP, 2200 V
- 1—7 X 6 Allis Chalmers, 250 HP, 440 V
- 1—64 1/2 Marcy Ball Mill, 100 HP
- 1—6 X 4 Denver Ball Mill, 100 HP
- 1—3 X 8 Hendy Rod Mill, 30 HP

Pumps, Sand

- 3—2 X 3 ASH Hydrosol Sand Pumps, A Frame
- 10—3 X 4 ASH Hydrosol Sand Pumps, B Frame
- 3—5 X 6 ASH Hydrosol Sand Pumps, C Frame



800 H.P. Nordberg Hoist

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- 1—4" Wemco, rubber lined, 30 HP, 440 V
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Screens

- 1—3' X 6' Symons Rod Deck
- 1—4' X 8' Symons Rod Deck
- 1—18" X 36" Denver Dillon Single Deck
- 1—3' X 10' Allis Chalmers Single Deck
- 14—4' X 5' Tyler Hummer Single Deck
- 6—3' X 6' Tyler Single Deck
- 2—4' X 10' Tyler Hummer Single Deck

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- 1—7' X 15' Delster Plato, 1 1/2 HP, 220/440 V
- 1—Size 6S Wilfley, 1 1/2 HP, 220/440 V

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- 1—50" X 9' Dorr "Torque", Type S
- 10—18 1/2" X 8' Dorrco & Wemco, Steel Tank
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- 1—22" X 6' Wemco, Low Head

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- 1—24" Sturtevant Axial Flow, 5 HP, 440 V
- 6—TM7 Coppus Ventair, 10 HP, 440 V
- 8—TM8 Coppus Ventair, 15 HP, 440 V
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- 41—20 cu. ft. C.S. Card, Z20, 18" ga.
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- 32—33 cu. ft. Ajax Type, 18" ga.
- 25—60 cu. ft. C.S. Card, Granby, 30" ga.
- 32—37 1/2 cu. ft. Ajax Type, 18" ga.
- 14—84 cu. ft. C.S. Card, Grandby, 30" ga.
- 5—85 cu. ft. C.S. Card, Granby, 30" ga.
- 7—100 cu. ft. C.S. Card, Slide Dump, 30" ga.
- 14—130 cu. ft. C.S. Card, Granby, 30" ga.

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- 1—625 CFM Ingersoll Rand, XCB, 125 HP, 2200 V
- 1—875 CFM XRE, 175 HP, 89n, 2200 V
- 1—1000 CFM Chicago Pneumatic, 6CB, 200 HP, 440 V
- 1—1050 CFM G. D. HA, 200 HP, G. E., 2200 V
- 1—1500 CFM Worthington, 300 HP, 2200 V
- 1—2000 CFM Worthington, 400 HP, 2200 V
- 1—2500 CFM Sullivan, WN4, 400 HP, West., 2200 V
- 1—3000 CFM Ingersoll Rand PRE-2, 575 HP, 2200 V

Generators, Diesel

- 1—75 KW Caterpillar D13,000, 220/440 Volt, Diesel
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- 1—75 HP Puget Sound Single Drum
- 1—170 HP Allis Chalmers Double Drum
- 1—300 HP Wellman Seaver Morgan, Single Drum
- 1—600 HP Vulcan Double Drum, 2300 V
- 1—800 HP Norberg Double Drum, Excellent

Locomotives

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- 3—1 1/2 Ton Atlas Type J, Battery, 18" ga.
- 1—2 1/2 Ton Jeffrey, 18" ga.
- 1—3 1/2 Ton Mancha Titan AX, 18" ga.

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- 1—Marcy Rod, 7' x 15', 4" liners, 300 HP.
- 1—Denver 4' x 10' Rod Mill, 60 HP.
- 2—A1-Ch. Ball-tube, 5' x 22', 6' x 16'.
- 3—Jaw Crushers, 20" x 6', 18" x 9',
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- 1—Gyratory Crusher, Kennedy #49, 100 HP.
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- 1—10" x 20" Austin-Western Jaw Crusher, R.B.
- 2—18" x 24" Universal Jaw Crusher, R.B.
- 1—36" x 50" Dixie Premier Hammermill
- 1—GD-9 Gardner-Denver Mucker, 18" Ga.
- 2—No. 21 Eimco Muckers, 24/36" Ga.
- 1—No. 40-H Eimco Mucker, 24/36" Ga.
- 1—100-Ten Standard Scale, 50' Long
- 3—200 KVA West. Transformers, 1/60/12,500—230/460

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Model E

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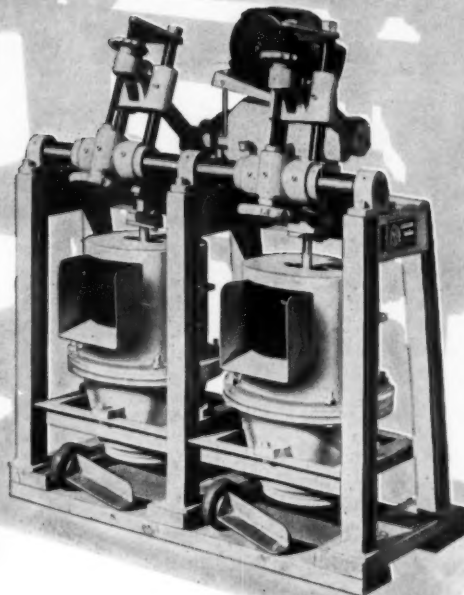
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Table below shows new capacities of DENVER Pumps by size. Compare with the pumps you may now be using. Why pay more for a bigger pump when a smaller DENVER Pump will do as much? Determine the capacity required for your operation, then select the pump that does the job.

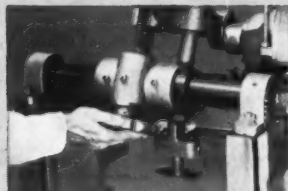
NEW DENVER ADJUSTABLE STROKE DIAPHRAGM PUMPS

DENVER Pump Size	Capacity—GPM*		Line Velocity At Listed Capacities
	SIMPLEX	DUPLEX	
2"	20	40	2.00 ft./sec.
3"	45	90	2.00 ft./sec.
4"	70	140	2.00 ft./sec.
5"	120	240	2.00 ft./sec.
6"	175	350	2.00 ft./sec.
8"	320	640	2.00 ft./sec.
10"	500	1000	2.00 ft./sec.

*at maximum stroke and normal speed. Stroke can be adjusted while pump is operating.



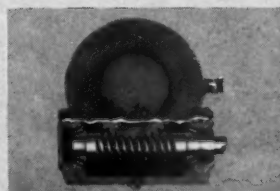
Sizes from 1" to 10", simplex and duplex, in capacities up to 1000 GPM —standard or acid-proof construction.



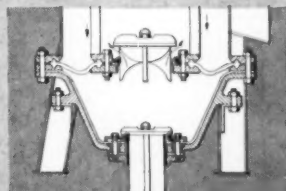
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AVDA Orrorantia 1570
San Isidro

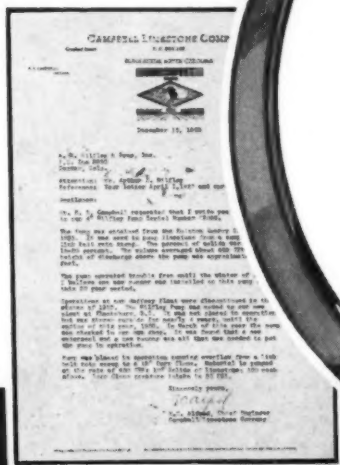
WILFLEY

SAND PUMPS

20 years service!

REPAIRS?... ONLY ONE RUNNER!

A Wilfley customer reports the following:



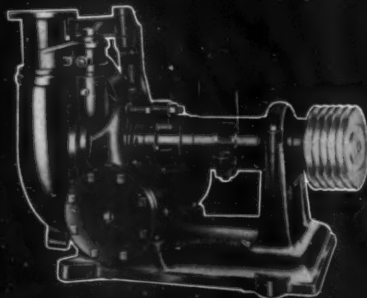
"The pump operated trouble free until the winter of 1953. I believe one new runner was installed on this pump during this 20 year period.

It was not placed in operation, but was stored outside for nearly 4 years until the spring of this year, 1958. In March of this year the pump was checked in our own shop. It was found that a new water-seal and a new runner was all that was needed to put the pump in operation."

Year after year Wilfley's
dependable, low-cost
pumping continues
to build.

Individual engineering on every application.

WILFLEY ACID PUMPS
"COMPANIONS IN ECONOMICAL OPERATION"
WILFLEY SAND PUMPS



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